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OCTOBER, 1904. VOL. XXIV. NO. 4.

The Geographical Journal

INCLUDING THE PROCEEDINGS OF THE ROYAL GEOGRAPHICAL SOCIETY.

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The
Geographical Journal.

No. 4. OCTOBER, 1904. Vol. XXIV.

RETURN OF THE NATIONAL ANTARCTIC EXPEDITION.

The safe return to this country, during the second week in September, of the National Antarctic Expedition in the *Discovery*, has brought to a close an enterprise which, for the value of the results achieved, is certainly worthy of a very high place alike in the roll of polar expeditions, and in the long series of peaceful enterprises for which, as well as for her warlike victories, the British navy has ever been distinguished. The expedition, it may be recalled, has passed no less a period than two years and two months within the Antarctic circle; and while, in the trying circumstances inevitable in such a case, much of the success is certainly due to Captain Scott's rare gifts for command, almost as much is to be ascribed to the devoted loyalty and zeal of officers and men. All alike have done splendid work, and all alike have earned the thanks of their countrymen. The well-deserved honours already conferred on the explorers by the King and the Board of Admiralty are referred to below.

The task entrusted to Captain Scott and his companions in the official instructions was one which in any case must make large demands on the courage and skill of all concerned. To have performed such a task would have marked the expedition as a success. But the explorers have done much more: the second winter and the second travelling season have more than doubled the importance and value of their work. The perils and difficulties have been great, and such as only polar men can fully appreciate; but the reward has been great also. Extensive geographical discoveries have been made, and careful surveys carried out, while in other branches of science the results are no less striking.

The discovery of a fossil flora in the far south is of great scientific importance, while the biological collections are quite unique, for they are the first ever made 700 miles to the south of the antarctic circle. The careful meteorological records are more than doubled in value by their extension over two years; and the same may be said of the magnetic observations, of which those taken with the Eschenhagen instruments form a continuous record, including 700 magnetograms. It is, of course, premature to anticipate final results, though there are fascinating problems awaiting solution; but it may be mentioned that whereas, on November 1, 1903, a magnetic storm prevailed from Potsdam to New Zealand, the same day showed one of the most important magnetic disturbances recorded at the *Discovery's* winter quarters. The value of the observations for declination, inclination, and total force during the memorable journey over the great ice-sheet is enhanced by the fact that the effect of local disturbances was completely eliminated. The observations will therefore be of use in fixing the position of the magnetic pole. The rest of the physical work, including gravity, seismic, tidal, and other observations, such as those for atmospheric electricity, were likewise steadily continued through both years.

It will be remembered that, after her voyage across the South Pacific and a successful passage through the Straits of Magellan, the *Discovery* touched at the Falkland islands in the latter part of July, although the news, which came by mail, was only received in this country a month later. It was quickly followed by the announcement of the safe arrival at the Azores, the probable date of arrival at Spithead being then given as about September 10. As throughout the whole voyage, the ship kept well up to time to the last, being signalled off Plymouth in the afternoon of September 9, and reaching Spithead early on the 10th. She was soon afterwards boarded by a party from the shore, including Sir Clements Markham, who, with various friends of the officers, remained on board during the passage to Spithead, where the ship was swung for the adjustment of the compasses, etc., afterwards steaming to the dockyard, which was reached about dusk. Both officers and crew were in the best of health and spirits, while the trim and well-kept appearance of the ship excited much attention.

During its stay in Portsmouth the expedition met with a most cordial reception both from the authorities and the general public, who alike showed a gratifying appreciation of the work done by the explorers. All, from the mayor downwards, exerted themselves to make the stay a pleasant one, and the arrangements for the first public reception of the members of the expedition were carried out with the utmost heartiness and success. A formal welcome was accorded to both officers and crew at a dinner given in their honour by the mayor (Major J. E. Pink) on September 13. Captain Scott sat on the right of the mayor, and among the guests were Mr. A. H. Lee, M.P., Civil Lord of

the Admiralty, Sir Clements Markham, Admiral Sir Vesey Hamilton, Sir Allen Young, Admiral Field, Rear-Admiral Henderson (superintendent of Portsmouth dockyard), and many others. In proposing the toast of the evening, the mayor spoke of the "British grit" displayed by the members of the expedition, and expressed the opinion that Captain Scott had been associated with one of the greatest peace victories of the British Navy since the days of Parry and Ross. In replying, Captain Scott said that out of thirty-seven who remained during the second winter, thirty belonged to the Royal Navy, so that in coming to Portsmouth they felt like coming back home. Sir Clements Markham spoke of the assistance rendered by the Admiralty, while Mr. Arthur Lee welcomed the expedition home in the name of that body.

The public reception of the expedition in London took place on September 16, and was of an equally cordial and successful character. The *Discovery* sailed from Spithead on the 14th, arriving at the East India Dock on the following afternoon. Invitations to a luncheon at the docks had been sent in the names of the Presidents of the Royal and Royal Geographical Societies to the officers and crew of the *Discovery*, and to a number of other guests, who assembled at 1 p.m. of the 16th in one of the warehouse sheds adjoining the docks, many of them having first inspected the ship as she lay alongside the jetty. Sir Clements Markham occupied the chair, and was supported by Mr. A. B. Kempe, treasurer of the Royal Society, the places of honour being filled by Captain Scott and Lieut. Armitage, respectively leader and second in command of the expedition. Among the company present were (of old Arctic explorers) Admirals Sir Vesey Hamilton, Sir George Nares, Sir Lewis Beaumont, Rear-Admiral Aldrich, and Sir Allen Young; Mr. W. S. Bruce, leader of the Scottish Antarctic Expedition; the Right Hon. W. E. Macartney; Sheriff Sir A. Reynolds, Sir Henry Bulwer, Sir G. Taubman-Goldie, Sir H. H. Johnston, Sir G. Mackenzie, Admiral the Hon. Sir E. Fremantle, Vice-Admiral Sir Arthur Moore, Vice-Admiral Sir R. Harris, Rear-Admiral Sir W. Wharton, Colonel Church, Mr. L. W. Longstaff, Major Leonard Darwin, Mr. J. F. Hughes, Dr. J. Scott Keltie, Sir R. Giffen, Sir H. Tozer, Capt. E. W. Creak, Capt. A. M. Field, Capt. D. Wilson-Barker, president of the Royal Meteorological Society, and Mr. Cyril Longhurst, Secretary of the Expedition. The ship's officers and scientific staff were, in addition to those already named, Lieut. C. W. Royds, R.N., Eng.-Lieut. R. W. Skelton, R.N., Dr. R. Koettlitz (chief medical officer), Mr. T. V. Hodgson (biologist), Dr. E. A. Wilson, Mr. H. T. Ferrar (geologist), Mr. L. Bernacchi (magnetic observer), Lieut. M. Barne, R.N., and Lieut. G. F. Mulock, R.N. Lieut. E. H. Shackleton, who was invalided home last year, was also present.

After luncheon the members of the expedition were welcomed by representatives of the Admiralty, the City, the Royal Society, and the Royal Geographical Society. The following speeches were made:—

Sir CLEMENTS MARKHAM said he was pleased to tell the officers and men of the *Discovery* that the King had been graciously pleased to summon Captain Scott to Balmoral for a few days. His Majesty had expressed the wish that the captain should take with him the photographs and sketches taken on the voyage, a request which doubtless would give pleasure to Dr. Wilson and Lieut. Skelton.

Vice-Admiral Sir LEWIS BEAUMONT said he had the pleasure of being the representative of the Admiralty on that occasion, as, owing to circumstances over which they had no control, the First Lord and other Lords of the Admiralty were prevented from being present. He was privileged to convey the following greeting from the First Lord to Captain Scott and his comrades: "Will you tell Captain Scott and his officers and men the satisfaction of the Board of Admiralty at the manner in which they have so thoroughly upheld the traditions of the Navy, and with what pleasure they greet them on their return to England?" He knew that the Admiralty always took a deep interest in explorations of this sort. They looked upon the work as being equivalent certainly to any other kind of peace work; indeed, as hardly inferior to the most arduous and distinguished service before the enemy. It was already known that the explorers had been rewarded with medals for their exploits, but this might be considered the official announcement, the First Lord's words being, "Will you also announce to them that His Majesty has graciously notified his intention to confer upon them a medal to commemorate their expedition, which will of course be worn by them as the Arctic medals of former expeditions have been worn;" and he might mention that the Arctic medal was not inferior in its significance to any war medal. Being an old Arctic, he desired to take this occasion of welcoming them on behalf of all the old Arctics. There were a number of gentlemen present who had had experience in Arctic discovery, dating as far back as 1850—such as the President of the Royal Geographical Society, Sir Vesey Hamilton, Sir George Nares; they were the veterans of Arctic exploration, and in their names and on behalf of all old Arctic officers he ventured to welcome home Captain Scott and his officers. There never had been jealousy among Arctic explorers, and in this instance all would be ready to give the very highest meed of praise to the present expedition. They had not only done their work most splendidly, but they had done it with a modesty which was a credit to all concerned. The Admiralty had already marked their approval of the work of the commander, by his promotion to the rank of captain, and would unquestionably mark their appreciation of the work done by his officers and men.

Sheriff Sir A. REYNOLDS, in the absence of the Lord Mayor, extended to the explorers the welcome and congratulations of the City of London.

In the absence of Sir W. Huggins, President of the Royal Society, who much regretted his inability to be present, Mr. KEMPE, treasurer of the Royal Society, extended a hearty welcome to the voyagers on behalf of that body. He said that he much appreciated the duty he had to perform, as he had been closely connected with the work of the expedition, and had had it constantly in mind. It would, indeed, have been difficult for him to have forgotten their existence, as hardly a week passed in which it had not been his duty to sign cheques for them. He was charged by the President, Council, and Fellows of the Royal Society to offer the party their warm congratulations upon the accomplishment of the arduous work on which they had been engaged for so long, and their sincere thanks for the manner in which they had carried out the scientific investigations with which they had been entrusted. He did not speak as an expert, but he felt satisfied that the additions they had made to our scientific knowledge were important, and that their importance would be shown in the future. It was, of course, inevitable that some time must elapse before the full value of the work done could be properly estimated,

and its meaning proclaimed to the world. The explorers, however, might rest satisfied that the results of their labours would be published long before the appreciation of those labours had faded away; that their endeavours were recognized by the nation was strongly exemplified by the action of the King. His Majesty had felt the nation's pulse, and had prescribed an Antarctic medal. The accuracy of the diagnosis and excellency of the prescription were evidenced by the glow of healthy satisfaction which had followed the dose. He (Mr. Kempe) had carefully refrained from referring to the names of particular workers on the expedition, because all deserved praise for what had been done; but he was sure they would pardon him for saying that they owed a particular debt of gratitude to Captain Scott for the consummate and continued care he had bestowed upon the health of the members of the expedition. As a member of the Finance Committee of the expedition, the fine condition in which the ship came back to our shores also appealed very strongly to him. He trusted the ship might find a proper and satisfactory berth, and that she might accomplish some good work in the future. On the Society's behalf, he wished them all long life and happiness, and other fields to conquer.

Sir Clements Markham, representing the Royal Geographical Society, desired particularly to express their warm thanks to the warrant officers for the admirable way in which they had conducted their several departments. They had splendidly supported their officers, and he felt strongly himself that the discipline which existed on board had largely contributed to the healthful condition in which all had returned home. He was afraid there were many frost-bites, but no amputations had been necessary, and he considered that was largely due to the way in which the men had obeyed the instructions of their officers. He also congratulated the crew for the manner in which they handled the sledges. It was due to officers and men all working so well together that they had achieved so great a success; and now that they had returned, it must be with feelings of melancholy in leaving so interesting a region. He did not think there could be any doubt that they would regret very much leaving the old ship. That was intended to be a paying-off luncheon at which officers and men could meet together, therefore there was a certain melancholy feeling about it. They would always look back to the recent period of their lives, and feel that they had had opportunities to make them better and finer men. All wished them happiness and success in their future lives.

Captain Scott, who was enthusiastically cheered on rising to reply, said he felt somewhat overwhelmed, and he could only thank the many friends of his comrades and himself for the interest they took in the ship before her departure and throughout the expedition. He was speaking before many old Arctic explorers who were able to judge of Arctic work, and that enhanced the difficulty of his position. He never expected such a welcome as they had all received, and the award which had been made had been deeply appreciated by all. They, as naval men, had seen before, and had coveted, the little bit of white ribbon which they had now received. When they came home and heard that His Majesty considered their services had earned that ribbon, they had the profoundest feeling of gratitude. With regard to himself, he treasured the promotion which had been extended to him, and he felt that he had been amply rewarded for all that he had done. He was pleased to hear the suggestion that others would be rewarded, for Arctic exploration was not a one, two, or ten men show, but it needed the co-operation of all. They had all worked together. A spirit of good-will and comradeship had been maintained throughout, and from start to finish there had been nothing but loyalty and a desire to work for the general good. There had never been a thought of selfishness. They had not been actually under the King's regulations, but at

the same time most of them were proud to be under them, and all in the ship had obeyed those regulations up to the letter. Whatever might come out in the way of scientific results, he could only say that the gentlemen who had been engaged in those investigations had done thoroughly hard and honest work, and more work than people generally knew. He was proud that he had been in command of such a company. He was very glad of having had an opportunity to say these things publicly, because now came the time when he parted from his comrades; now was the sad time of the breaking up of their small community. They had been a happy little body, and they parted from the *Discovery* with extreme regret. He thanked all present for the generous way in which they had welcomed them home.

The proceedings terminated with the toast of "Sir Clements Markham," proposed by Colonel G. E. CHURCH, and a brief reply.

In the evening of the same day, a dinner of the Royal Geographical Society was held at the Criterion Restaurant. The guests included the officers of the expedition, and most of the visitors who were present at the luncheon. To the names of the old Arctic officers given above must be added that of Admiral Sir Leopold McClintock, who had been unable to be present at the earlier function, while the representative character of the gathering was enhanced by the presence of men of science like Sir W. Thiselton-Dyer, Prof. Sylvanus Thompson, Dr. W. N. Shaw, Mr. A. B. Kempe, and others. A large number of the members of the Society and their friends were also present, and the company altogether numbered nearly 300. The speeches which followed the dinner were listened to by a number of ladies, including several of the friends of the officers, and the giving of the toasts was interspersed with musical performances, including the singing of "Home, Sweet Home."

The PRESIDENT proposed "His Majesty the King, the Patron of the National Antarctic Expedition." He said His Majesty had taken a deep interest in geographical matters since his early youth, and he had within the last few hours shown how great was the interest that he continued to take in the explorations and labours of his subjects for extending our knowledge of the Earth's surface.

In proposing "His Royal Highness the Prince of Wales, Vice-Patron of the Expedition," the PRESIDENT said he should never forget the encouragement which he received from His Royal Highness at a time when he was almost in despair of being able to send out a relief ship.

The PRESIDENT next proposed "The Health of Captain Robert Falcon Scott, R.N., Commander of the Expedition." He said it was his pleasing duty to propose the toast of the evening. Superlatives were unnecessary; they all knew what Captain Scott had done. Captain Scott had made himself acquainted with all that had been done in the Arctic regions, but the conditions which prevailed in the Antarctic regions were in many respects very different, and he had been to a great extent an original polar traveller. They had not yet been able to read a full account of the journeys which Captain Scott had caused to be made, or of the magnificent journeys which he himself made over the ice. But they knew the distances that had been covered, and he thought they might say the journeys had not been surpassed, either in the difficulties overcome or in the importance of the results. Captain Scott might be described as the creator of sledge travel in the Antarctic regions. He had done a great service to his country. He had had

most able assistance, and had shown himself to be a great commander. He was sure that Captain Scott and his officers would wish him to mention the hospitality and invaluable help that they received from the colony of New Zealand.

Captain SCOTT, who again met with a most enthusiastic reception, said it was three years since he entered into the employment of the two Societies which sent out the expedition. He entered into that new employment with considerable trepidation, and, he might add, with considerable ignorance of his subject. But whenever he asked for advice or assistance he was able to get it from the members of those Societies. He would like to tell them a great deal about the Antarctic, but he was sure there was not time that night. He would like to draw their attention to the facts which went to make such success as the expedition accomplished, and to bring to their minds a vivid picture of the work accomplished by the various officers and men. He would like to present to their minds the picture of Mr. Hodgson, staggering in with his arms full of frozen specimens, and distributing them over the ward-room table; of Mr. Royds, who had every morning to change his records with frost-bitten fingers; of Mr. Barne, who, on his famous sledge, the Flying Scud, disappeared in the darkness, nothing more being heard of him until, when they were getting anxious and were preparing a search party, he appeared on the scene again. He would like to tell them of Dr. Koettlitz, and all the rest of them. All were equally diligent, and it was to their continued diligence that they owed anything like success. In addition to that, they had good fortune in finding their winter quarters. They arrived at them by chance, but he did not believe that a more suitable spot could be selected. Their detention for a second winter was also extremely fortunate, though it did not appear to be so at the time. It had often astonished him since to think of the number of false impressions in regard to matters of detail that they would have come home with, and the number of facts that would have remained unobserved, had they returned a year sooner. It was to the second winter that they owed any measurement of the movement of the ice in those parts. Without it, they would have missed the great discovery of the fossils; they would have missed the great biological collection which Mr. Hodgson continued to make; and they would have missed knowledge of the interior of Victoria Land beyond the immediate mountains. Moreover, they would have missed two consecutive years of meteorological and magnetic observations. Although it caused them considerable anxiety and annoyance to stop behind, yet he could never look upon the circumstances as anything but a blessing in disguise. The Antarctic campaign at the beginning of this century was now practically at an end. It had been the greatest pleasure to him, on returning home, to receive telegrams and letters of welcome from others who had conducted expeditions to the southern regions. He had received the kindest letter from Prof. von Drygalski, and the kindest congratulations from Mr. Bruce, who was dining with them that night. He was able to return those congratulations, for Mr. Bruce's expedition went to a point of extraordinary interest, and in finding the limits of the Weddell sea had done precisely the work that they could have most wished to see done. Sir Clements Markham had spoken much too highly of his services, and he could only thank him for his kindness. He wished especially to thank him and the secretary of the Expedition Committee, Mr. Longhurst, for the great care they had taken to keep their relatives posted with the latest news of their movements.

The PRESIDENT then proposed "The Health of the Members of the Expedition." He said he wished that all the members of the expedition were present. They had had the great pleasure of sitting down with the warrant officers and men earlier in the day, and they now had with them the officers of the expedition. Captain Scott had told them how they had worked; they went forth with a determination to

distinguish themselves as explorers. They took with them the banners which they saw behind him, and carried them into parts of the Earth where the human foot had never before trod.

The toast was cordially honoured, the company again rising and cheering heartily.

Lieut. ARMITAGE, R.N.R., who first responded, expressed the pleasure it had given him to be associated in the work with officers of the Royal Navy, dwelling also upon the loyal help rendered by the warrant officers and men. They could have done nothing if they had not had a commander who was also their comrade, and for whom they felt they could do anything, at any sacrifice.

Dr. KOETTLITZ, speaking more especially on behalf of the scientific staff, referred to the great interest taken by Captain Scott in their work, without which their task would have been far from easy. Captain Scott had been at great pains to make himself acquainted with the various branches of science to which their attention was devoted, with the result that he was able to discuss with them their methods of work, and make valuable suggestions. Captain Scott's promotion had given them all the greatest delight, and they looked upon it as an honour conferred on themselves.

Lieut. SKELTON dwelt on the many incentives which had spurred them on to do their best. Most of them belonged to the navy, and they felt that its reputation was to be jealously guarded. Moreover, the great interest of their work could not fail to make them keen to do all in their power, while no merit lay in loyalty to such a commander as Captain Scott.

Major DARWIN proposed the toast of "The Subscribers to the Expedition," saying that without their liberality the expedition could never have taken place. He spoke especially of the great assistance rendered by Mr. L. LONGSTAFF, who, in replying, laid stress on the importance of scientific research, which made it incumbent on all who had the power, to further it in every way possible.

The last toast of the evening was that of "The President," proposed by Sir GEORGE GOLDIE, who spoke of the debt which the expedition owed to Sir Clements Markham's untiring energy and faith in its ultimate success. The PRESIDENT, in reply, said that his strongest motive throughout had been the wish to afford the navy the opportunity of taking part once more in one of those enterprises which supplied so valuable a training in times of peace.

A JOURNEY TO THE NORTH OF THE ARGENTINE REPUBLIC.*

By FLORENCE O'DRISCOLL.

THE greater part of the journey I am about to describe was over a tract of country lying near the extreme north of the Argentine Republic, close to the borders of Chile and Bolivia—in part over the territories in dispute between Argentina and those countries.

For the purpose of description, the travelling began at the town of Jujuy, the capital of the Argentine province of Jujuy—also the terminus of the railways from Buenos Aires and other ports to the south. For travel northward from the town of Jujuy, arrangements were

* Read at the Royal Geographical Society, May 30, 1904. Map, p. 504.

made for mule or horse troops. Although men were there who offered what they call good carriages and horses, I strongly advise travellers to depend solely on troop-mules for baggage and riding-mules for men.

The Argentine Government were continuing the railway past the town of Jujuy, with the view of eventually connecting with the railways in Southern Bolivia that are linked with the Chilian railways whose ports are on the Pacific side of the Cordilleras. The construction of the railway past Jujuy has moved very slowly, since the border disputes between Chile and Argentina have progressed amicably. The route of road and railway north from Jujuy follows a natural valley—a river-bed, sometimes almost a cañon—that extends far into Bolivia, with an almost unvarying northerly direction, and the valley rises the whole way with a fairly regular slope. In July, 1903, the railway works had not extended more than 4 or 5 miles north of Jujuy. Along the route (known as the "Quebrada de Humahuaca") there are no special difficulties for railway engineers; they have simply to keep their line out of the river-bed and push it northward. There is, however, about 20 miles north of Jujuy, a place that may cause some difficulty, locally known as "El Volcan;" it is reputed to be a mud volcano, flowing across and down the valley. As I passed I examined it with some interest, but found it was not a volcano at all. There the valley was about $1\frac{1}{2}$ mile wide; to the left or west there was a chain of hills, rising perhaps at their highest point 2000 feet above the river-bed. One of the highest of these peaks—still one of the highest, and indeed a very massive mountain—on the eastern side was mainly composed of fine, pasty, argillaceous matter that in wet weather held water like a sponge. The side of the mountain nearest the valley had broken away, and slid through a somewhat narrow gorge into the main valley, and poured its flow of mud completely across it. Always in wet weather vast masses of this stuff slide down the hollow cone-like sides of the mountain into the valley, and, together with millions of tons of the mud already in the valley, all take up water, and tremble and shake with the least vibration like a jelly on a hot day. Of course, while in that condition the bed of the valley is quite impassable; the mud-slide can only be passed by keeping up the hillsides, n an extremely difficult and very broken road situated on the opposite side of the valley to the mud mountain; usually no one attempts to travel while the mud-slide is in a bad condition. The place presents some terrors to the natives, and weird tales are told about the suddenness with which the "volcano" works; but if the tales be analyzed, they will be found always connected with heavy rainfalls. The place naturally retains moisture long after the surrounding country is quite dry, and the damp mist that fills the valley, with greater or less density according to the amount of moisture drying out of the mud-slide, is generally referred

to as "smoke from the volcano." But there is no volcano; of this I was fully satisfied, after riding over the mud-slide and examining the mountain-sides with a powerful glass from a distance of about a mile. My view was verified subsequently by the chief of the Government railway, whom I met in Buenos Aires months afterwards. He said he had formed the same conclusions, after having examined the place in detail. The difficulty which it will present to railway construction will be one of drainage. When I passed over the place it was in the winter, when everything was dry; indeed, had I not experience of places similar to this in other parts of the world, I should have had much difficulty in believing the soft, jelly-like condition which the greater bulk of this vast mud-slide attains during the wet seasons of the year.

The valley from Jujuy northward is the main road to Bolivia, over which almost all the loading from the northern Argentine railway passes daily. Mule-trains, with sometimes as many as fifty or sixty animals, were continually met, each mule loaded up with cases or manufactured goods, tea, tobacco, flour, and general merchandise. As a rule, the returning mules carry alfalfa (lucerne) and timber to the higher lands in Argentina; and in lower altitudes nearer Jujuy, I noticed cargoes of apples and some cacao which had been brought from Bolivia, the great bulk of the other loading having been sold on the way south; but generally the greater number of mules return empty. In this valley I first saw pack llamas—the animals that do almost all the carrying in the higher lands of Bolivia.

We rode for five days up the valley; sometimes it was 2 or 3 miles wide, sometimes but 100 yards or so, rising slowly all the time, with a small stream, 15 to 20 feet wide and 12 to 18 inches deep, rushing down somewhere over the interminable stones and boulders that covered the entire valley bed. The hills on either side varied in contour every mile of the way; sometimes only a couple of hundred feet or so above the river-bed, in other places rising to 2000 or 3000 feet high. I was not sufficiently interested to turn aside and examine them geologically, but from the distance of the river-bed I could not observe anything but very recent sedimentary formations in their entire structure. At Jujuy the height was 4200 feet.* Each day I travelled from 20 to 25 miles northward, and rose about 2000 feet. The second day out I passed Tumbaya—known to those learned in the earlier history of the country as "Tumbaya la bella." There are few legends current of the Spanish occupation of this country, but almost every one in the locality knows the legend of a Spanish priest, who, a couple of hundred years ago, settled at Tumbaya with a view of converting the

* All the heights I shall give are barometric readings, corrected as far as possible from sea-level observations.

Indians. After many years he left it, and all the history remaining is his anathema of the place and people. Now Tumbaya is a collection of mud huts, a plaza—fenced with wire, and full of broken bottles, empty tins, and rubbish—and a Government telegraph station. There was hardly a sign of life as we rode into the town; the few wretched dogs had hardly energy to bark. The lines of the long-forgotten priest are its only record of distinction.

All along the valley, wherever there was a collection of houses, I was greatly struck with the character of the architecture; like Arab or Moorish villages, one great wall without windows surrounding them.

ONE OF THE PASSES (NEARLY 17,000 FEET ABOVE SEA-LEVEL) APPROACHING THE "SEPULCRO," IN THE DEPARTMENT OF THE ANDES, ARGENTINA.

The country is very quiet now—safe enough for a bevy of school-girls to travel it by day or night; but still the peculiar architecture remains. At Negra Muerta, where we camped, there was only one large building, once the headquarters of the Estanciero, who owns hundreds of square leagues of the surrounding country, but now tenanted by his manager, a superior sort of half-breed Spanish Indian, with his family. There was the huge square outside wall without windows of any kind, one arched doorway, and the inside house or houses built against the outer wall and facing into a patio—a most Moorish-looking place. Truly the occupation of Spain by the Moors has left its deep markings; they extended across to the New World, influencing to-day even the customs of the Indians of Spanish South America.

At Negra Muerta our road turned out of the valley to the westward, with Cochinoca and Rinconada as its objective. Cochinoca was settled from the western coast, and is one of the oldest settlements in Argentina. It is now a small trading station, almost lifeless, a mere collection of a few houses built of stone slabs and mud mortar, two churches, and a few huts, all nestled close together on the upper western slope of one of the chains of hills that intersect the plateau from north to south. Near Negra Muerta a few porphyry dykes crossed the country, and the older sandstones began to appear from amongst the very recent sedimentary deposits general hitherto. We were then about 11,000 feet above sea-level, and the trees were becoming very stunted, and vegetation more sparse. Five or six miles of travelling up the bed of a valley coming in from the westward brought us on to a treeless plateau some 12,000 feet above sea-level. This plateau extends some 250 to 300 miles from north to south, and is 50 to 60 miles wide. It is intersected by numerous small hills, singly or in chains, and by ranges of mountains, all running in the general direction of north and south. Where we entered the plateau, on its eastern side, sandstone rocks, very much foliated and twisted, were everywhere apparent; but as the tableland was crossed in a westerly direction, the hills jutting up from the plain, like mountains from the sea, were found to be of slate formation.

It cannot be said that there are any important rivers on this plateau. There are some minor rivers and dry river-beds that become torrents in wet weather, but these generally terminate or flow into large shallow flat lakes, completely dry in winter. Sometimes in winter there are places where the water remains in low-lying swampy ground, and these swamps were literally alive with aquatic birds—bright-plumaged flamingoes, geese, swans, wild duck of many species, and cranes, herons, and long-necked wading-birds of great variety; in summer time, when the depressions are full of water, they are remarkable for the numbers and variety of aquatic bird-life. It was on the edge of this plateau that I first saw the wild vicuña grazing in small herds like deer—very timid, and rarely approachable closer than 700 to 1000 yards. Huge herds of tame llamas were grazing like cattle on the plains. The sky was clear, blue, and cloudless, and occasionally a condor, like a black dot, moved across the line of vision. The locality is pretty well mapped, and the natural features shown may be taken as fairly correct, but without some description of the rivers and lakes, the information on the maps may be very misleading. As a rule, from which I saw no deviation, the rivers shown to run into inland lakes do not flow all the year round, and the inland lakes are not lakes at all except in the wet season; in the dry (winter) season they are either dry plains covered with fine grasses and rushes, or dry clay-surfaced areas crusted with salt, magnesia, borax, or some other of the alkalis. For instance,

the "Laguna del Portezuelo," shown as a lake some 60 or 70 miles long, and 18 or 20 miles wide, is in winter a grazing-ground for sheep; its surface seemed as flat as a billiard-table. I rode across its centre and along much of its length. A few scattered habitations were built above the wet season high-water mark of its shore; the dwellers in these had difficulty to find enough water in the winter for their domestic requirements. The same winter dryness existed on the "Laguna de Guatayoc," and the other salinas to the south; but on them the saline deposits took the place of the grasses of the more northern "lagunas." In the south the glistening white deposits and immense flat distances (in winter

THE GOVERNMENT AERIAL RAILWAY IN COURSE OF CONSTRUCTION FROM CHILECITO TO THE FAMATINA MINES, SHOWING FAMATINA MOUNTAIN, 21,000 FEET HIGH, 25 MILES DISTANT.

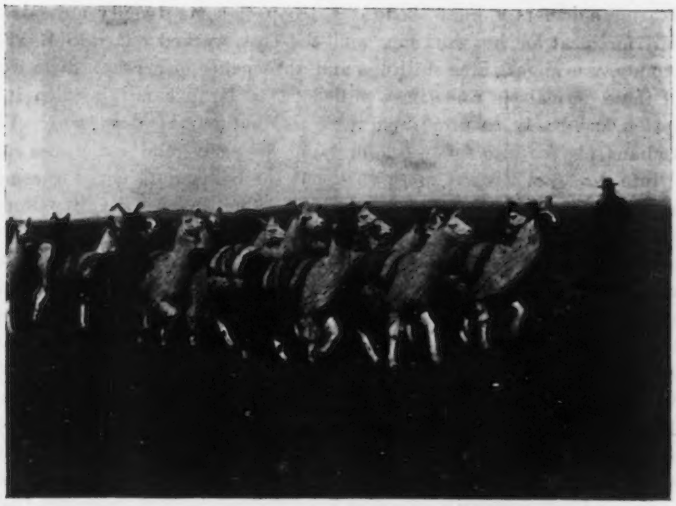
absolutely dry) gave all the appearance of inland seas. The mirage was almost always to be seen, and the reflection, and sometimes double reflection, of the islands in the lakes, or mountains at the back of them, could be seen whenever the sun shone on their surface. I have seen troops of vicuñas within one of these dry pans, fully 10 miles from the shore-line. They had come down the mountains for "salt-lick," and seemed to be standing in water up to their knees. I tried to stalk them, to get a skin or two, but they vanished into the mirage, and when I followed to where I first saw them, their hoofs had barely made tracks on the dry earthy crust of the alleged lake.

The plateau seemed to be very sparsely inhabited; once or twice in a day's journey something in the distance looking like a boulder turned

out to be a human habitation—a wretched structure of mud and grass, not 12 feet square and 6 feet high. Generally attached to such habitations was a corral or large yard, with a sod or mud wall, into which the llamas or sheep were herded at times, and in some places herded every night near mountains or broken country where pumas are. The inhabitants, as far as I saw them, both on the plateau, in the mountains on the plateau, and in the settlements, were about equally composed of three classes. The first, dark swarthy men and women—pure-blooded whites of Spanish extraction; the second, pure-blooded, straight-haired, fine-featured Indians, something like the North American red man; and the remaining one-third, a mixture between the two races. All spoke Spanish, which seemed to have entirely displaced the native languages. Their religion was nominally Roman Catholic; in the larger towns it was strictly so, but in the smaller settlements it appeared to be a mixture between the Roman Catholic ritual and some rites of a long-forgotten Indian creed. All the men, from the peons to the highest in the land, were delicate, refined, and courtly in manner, and hospitable to an extraordinary degree; yet when it came to paying those who expected payment, they were by no means modest in counting up the bills. The people in the settlements were generally small traders, who bought skins and gold, and had a few soft goods, hardwares, groceries, and spirits for sale—all of fifth or sixth rate quality, and the keepers of these stores seemed to lead a very listless life. I cannot say that the people outside the settlements followed any industry; they seemed contented to live, with a minimum of intelligent existence, bodily comforts, and food. On the plains, the children tended the sheep and llamas; the women pottered about the huts, or wove cloth, or made garments, and did such meagre cooking as was indulged in; the men did not appear to have any special employment—they usually seemed to be occupied with squatting in the sun, smoking cigarettes. Every one who has read the histories of the Incas has marvelled at the tales of the native runners, who were a feature in the civilization of that period; some of this race of men still remain. I have often had a telegram delivered at the station, 40 miles distant from where sent, and an answer received and brought back by the same man, all, including the journey of 80 miles, not occupying more than eighteen hours; the man was well content to receive two Bolivian dollars, or three shillings in English money, for the service. I saw a man who delivered a message 200 miles away and brought an answer back, covering within six days and nights 400 miles. As he did this work for a native, his charge was five Bolivian dollars (seven and sixpence English money), out of which he provided his own food. All the men were runners and walkers—even the little children could run up a mountain without any apparent trouble.

The soil seemed to be excellent, soft, grey, and loamy in character,

and I feel certain it would grow alfalfa (lucerne) and cereals, such as oats and the hardier kinds of cold country grain, most excellently. During my entire journey in the north, covering over 1000 miles, I did not see one square yard of cultivation. The altitude of this plateau prevents a luxuriant vegetation. Coarse, spiny, rush-like grasses, with finer grasses hidden amongst them, appeared to thrive at heights up to 12,000 feet above the sea; above 12,000 feet the grasses gradually disappeared, and shrubs began to take their place; at 15,000 feet there were only a few shrubs; at 17,000 feet nothing but bare stones—even the mosses, lichens, and lower forms of vegetation had entirely disappeared—and yet I have seen troops of vicuñas on these barren stones. Travel across these lands



A TROOP OF LOADED LLAMAS CROSSING A PLATEAU (ABOUT 14,000 FEET ABOVE SEA-LEVEL) IN SOUTHERN BOLIVIA.

is more pleasant in winter than summer. In lat. 22° to 23° S., even at 12,000 feet above sea-level, although very cold at night, the sun was pleasantly warm during the greater part of the day, and except on grey days, when there was a wind storm, it was quite exhilarating to ride across the country. But in summer the sun beats down pitilessly, and the heat and dust are very disagreeable, and very frequently rain and snow storms are encountered.

On the western side of the plateau, on the Sierras de Santa Catalina, more sheep appeared to be grazed than on the plains; it was not uncommon to meet three or four times each day flocks of from 150 to 200, generally tended by an Indian child about 2 feet 6 inches high, clad in rags. As far as I could learn, these sheep were grown

and used mostly for food, their wool being taken from the dead pelt; I did not hear of any wool being sent out of the country. The llama, too, is never shorn; their wool drops off in great bunches whenever it has attained its full length of staple—some 8 or 9 inches. The llamas are bred for pack-animals, and they are also killed and eaten. I did not taste any, as I was told the flesh was very rank. All I saw killed (animals as big as a red deer) seemed lean, sinewy meat without any fat; they fed chiefly on a coarse shrub called "tola," * which grew in higher altitudes than grass. I have seen the llamas 16,000 and 17,000 feet above sea-level, apparently quite happy, and thriving well on tola and other coarse and strong-smelling shrubs. The value of the animal before being broken-in for packing is not very great. One of the mine-owners I knew bought a troop of some twenty animals to kill for meat for his workmen, and the cost, worked out into English money, was about three shillings and threepence per head. The wool of these animals is sometimes pulled off in large handfuls when it is rotten and ready to drop, and it is also cut off the dead pelt. The Indians plait it into soft ropes for tying on packs, and sometimes spin it into thread and weave cloth of it, but the llama cloth is not esteemed as highly as cloth made of sheep-wool. The natives say it will not stand the same wear as sheep-wool cloth, and that it is brittle; but to my mind this is not to be wondered at, for no care is taken to cultivate the wool. There ought to be an opening for an industry in cultivating and supplying this wool to European markets. Something, too, might be done with vicuña wool; it was common to see 200 to 300 vicuñas each day. Though very timid and wild, they are easily driven; they will not cross a pack-thread stretched along the ground. The wool of the vicuña is very highly esteemed; the equivalent of ten to twelve pounds sterling is often paid locally for enough of the choice wool to make a shawl or poncho. The Argentines, the Bolivians, and the Indians of both countries organize huge drives; in each drive hundreds of vicuñas are killed with "boleadoras," lasos, sticks, and stones. It may be safely said that no man wears any vicuña cloth made of wool taken from a living animal. It is the timidity of these animals, and their extraordinary wariness, that alone prevents their extermination. The animals seen on the ranges and plateau were wild vicuñas and tame llamas, sheep, mules, donkeys, but very few horses, and no horned cattle. Of the smaller wild animals, large numbers of viscachas † were always seen in cliffs and steep rocky ground. This is an animal in size and appearance like the opossum, but the tail is not prehensile; although to be seen all day long, the animal probably does most of his moving about and feeding during the night, for his eyes are beady and protruding like night prowlers, and the whiskers or feelers are

* Cobo, p. 486, *Baccharis Incarum* (Weold).

† (*Viscacha*) *Lagidium Peruvianum.*

abundant and long, sticking out from $4\frac{1}{2}$ to 6 inches on either side of the muzzle. The grey fox, of two sizes—one small and the other a little larger than a full-sized English fox—was frequently seen, and the "red" fox, a handsome black-and-tan animal a little larger than an English dog-fox, is met very occasionally. On all the high mountains the chinchilla used to be found, but they are now nearly exterminated. There was a rat-like burrowing animal all over the plateau and up the mountains; I have found their burrowings close together even above 17,000 feet high; in places their colonies were so dense

AN ANCIENT SPANISH MINING VILLAGE, NOW IN RUINS (ABOUT 14,000 FEET ABOVE SEA-LEVEL). THE OLD CHURCH TO THE LEFT OF THE PHOTOGRAPH IS DATED 1735 DEPARTMENT OF RINCONADA, ARGENTINA.

that it was dangerous to ride fast over the ground. The animal is called the tucutuco, and the natives call the hole tucutucales.

Of the large tract over which I travelled, the part that interested me most was the chain of mountains running almost due north and south, generally named on the maps the "Sierras de Santa Catalina." These mountains pass south below the province of Jujuy, and continue north into Bolivia past the town of Santa Catalina on the Northern Argentine border. Over a stretch of country along that range, measuring as the crow flies some 200 miles, I rode backwards and forwards many times during my journey. The whole of this range, as far as I

could observe, was composed of slates on edge; practically, it may be said that no other rocks exist, although in parts small quantities of granite or sandstones were seen; but primarily it is a slate country, tilted until the slates are almost vertical. For hundreds of miles these slates run in almost unbroken lines, with the regularity of ridges thrown up by giant ploughshares. My search for fossils was entirely unproductive; nor could I hear of any having ever been found there. Although at one time the strata forming the present mountains were below sea-level, it was disappointing not to find any fossils or traces of them in the rocks. As far as I could judge, the greater part of the surface of this range was gold-bearing; that is to say, in every gully or valley, where water runs in the wet season, there were traces of old gold-workings—in many cases very extensive indeed. I can say without exaggeration I have not washed a pan of dirt scraped from the hillsides without finding, at least, a colour of gold. Naturally the concentration for ages by wind, weather, and water over the surface of such country would cause the beds of the watercourses and gullies to be more markedly auriferous; but from what I could see, I am of the opinion that all the very rich patches of heavy alluvial gold contained in the creek bottoms and gullies that did not carry much water, had already been taken away, either by the people who were before the early Spaniards or by the Spaniards. I could find no record of any extensive workings being carried out by the people of the country since the Spaniards were driven out during the War of Independence one hundred years or so ago; but a good deal of fine gold comes down each year in return for the trade and merchandise sent into the country. The amount of work done by some people of the past was enormous; as to when the work was done, or by whom, the present inhabitants seemed to know nothing. Close to the town of Rinconada, to the north, a deep lead must have existed, for hundreds of acres of the hillsides are covered with the mullock-heaps from disused and fallen-in shafts sunk down to the gold-wash; these give evidence of systematic work of a most extensive character. The town is built on the side of the Santa Catalina range, about a mile away from and 500 feet above the edge of the plain. Between the town and the plain hundreds of thousands of tons of mullock (overlying a bedrock or false bottom 4 or 5 feet deep) have been turned over and washed, and no sign remains to-day of where the water came from to do such extensive washing. The people who live on the Santa Catalina range, for the greater part half-bred Indians, differ a little in their habits from the shepherds or graziers—dwellers of the plains—who live many miles away from any auriferous ground; here on the range the men, women, and children wash gold in the gullies and watercourses during each wet season, and in some places the men carry on continuous work during all seasons of the year. The work an Indian can do with a "batea," exceedingly fine as it is, may provide

ONE OF THE SPURS OF THE SANTA CATALINA RANGE (HEIGHT ABOUT 14,000 FEET ABOVE SEA-LEVEL), SHOWING THE TILTED SLATE FORMATION OF THESE MOUNTAINS. DEPARTMENT OF RINCONADA, ARGENTINA.

THE QUEBRADA OF AJEDREZ (ABOUT 14,000 FEET ABOVE SEA-LEVEL). DEPARTMENT OF RINCONADA, ARGENTINA. SHOWING THE MOUNTAIN OF GRANADA, 20,400 FEET HIGH, 25 MILES DISTANT.

for his small necessities, but it would not pay white labour to work on the same lines, therefore I consider the greater part of the range is valueless from the point of view of mining; it could not be profitably worked by modern machinery, owing to the thinness of the wash overlying the slate, and the absence of water to admit of work upon a large scale. Seeing so much alluvial gold spread over such a large area, at first I naturally expected to find gold reefs to account for the gold on the hillsides and in the valleys, and I searched for them continually; but I must candidly say, I have never ridden over such a large area of auriferous country and seen so few quartz outcrops. I am therefore obliged to fall back upon the hypothesis that the greater part of this slate country contains a vast quantity of fine auriferous quartz leaders, some of which may be perhaps not thicker than a sheet of paper; from the breaking down of these when the slate matrix weathers, the gold found in the valleys and watercourses is derived.

To the south, some 30 to 35 miles from the town of Rinconada, there is a very remarkable place known as Ajedrez. It is situated on the western side of the Santa Catalina range, and between the bottom of that range and the Oromayo river, which flows to the northward some 1½ to 3 miles eastward from the range. There a white sandstone country came in and abutted sharply against the dark tilted slates of that range, and the whole of the sandstone for an area of about 15 miles long and 1½ to 3 miles wide was covered with the broken and weathered slates from the range, that have weathered and washed down and flowed over the low ground between the range and the river, until hundreds of millions of tons of their detritus covered the sandstone with an alluvial wash composed of all sorts and sizes of slate stones, from rough, round-edged slabs 2 or 3 feet in diameter, 5 or 6 inches in thickness, down to little pebbles and sand, all cemented together with friable grey material. Fine "fish-scale" gold, worth over three pounds fifteen shillings per ounce, is contained in varying quantities in this wash. In some places the sandstone bed appeared quite bare, in other parts it was only covered a few inches deep by broken-up slates, in other places the wash was 15 or 16 feet deep, while occasionally it looked as if the slate wash were over 100 feet deep; and the area of this deposit was some 20,000 acres or so. The sandstone country was intersected by several rivers or mountain streams, that ran from deep ravines in the mountain range directly across it into the Oromayo river. If any of these ravines, or "quebradas," were followed down from the crest of the mountains, the tilted slate country of the Sierras de Santa Catalina could be seen in section where the watercourses cut their way through it. In some places the rocks rose on either side 700 or 800 feet high, and from there sloped away to a height of 1200 or 1500 feet to the tops of the spurs leading from the main range. The top of the range was in places fully 3000 feet above the Oromayo river. The most important

of these ravines is known as Ajedrez, and it is from this that the vast tract of auriferous country takes its name. Down the Ajedrez ravine for a length of about 1½ mile, both sides of the watercourse were once closely built upon; the ruins are at present in a fairly good state of preservation, and must at one time have housed a population of between 2000 and 3000 people. High on the mountain-side, 1000 feet above the large building once used as a police depôt, or headquarters for officials (where the English engineers now working the place reside), there was another old village, with the ruins of a Spanish church. There were evidences of great activity in the immediate locality, for not only had a length of about 2 miles along the bottom of the ravine been turned over and washed, but the river-bed was one mass of old shafts, sunk to get down into the wash below. All round the ruined Spanish village and church, up the mountain-side, there were the remains of old workings. Very extensive remains of "acequias" or water-ditches followed the contours of the sides of the ravine, and led down into the river-bed where gold-washing was carried on; the tradition is that the bottom of the watercourse was turned over and washed three or four times. As the stream approached the plain several gullies joined it from either side, and in all of them there were remains of old buildings and gold-washings. The water from these gullies augmented the main stream flowing on the surface and below the stones and gravels, and here ceased all traces of the turning over of the river-bed or of shafts to get to the wash below. There was no cause apparent for assuming that the gold in the river-bed gave out, and it is logical to reason that the work stopped for want of means to deal with the heavy and increased water-flow. At any rate, there was over a mile of the bed of the watercourse before it joined the plain, and immediately below the very extensive old works, that may be considered as virgin ground. The quebradas of Anticuyo, Casa Mucha, Chirigoya, Coyaguima, and others—in fact, every quebrada extending from the mountain range down to the Rio Oromayo, and crossing the auriferous ground, contained extensive ruins of the houses of the old gold-washers. In almost all these places a small population, who had roofed some of the ruins, lived in them, and these people made enough for their wants by turning over, again and again, the often-washed ground. The old time gold-seekers only washed in the bottom of the watercourses, where the gold was concentrated and easy to obtain; they evidently had no means of dealing with the deeper ground that carried much water. The native inhabitants of to-day appeared to be similarly situated, for they only had small shovels and "bateas" (flat wooden dishes shaped like the Chinaman's hat pictured on tea-boxes). Not only were the same class of ruined stone buildings, shafts and heaps of turned-over tailings visible around all the old settlements, but the mountain-sides above them were lined and seamed with old acequias that at one time carried the water

to the gold-washings. Truly there must have been great activity in the quebradas crossing the Ajedrez auriferous area, for the ruins of the settlements suggest that certainly not less than 4000 people must at one time have lived there. Although the ancient gold-washers gave much attention to this place, and picked the choicer places, it appeared to have been neglected for years; but now some English engineers of the Rinconada Company are working at Ajedrez with satisfactory results. They spent a thousand pounds or so in making new water-ditches and some sluices, and are ground-sluicing the auriferous slates and gravels overlying the white sandstone, and getting a net return

THE DESERT OF RIOJA, ARGENTINA. OUTSIDE MR. W. A. TRELOAR'S QUINTA NEAR CHILECITO (ABOUT 3000 FEET ABOVE SEA-LEVEL).

of over one shilling and sixpence worth of gold for each cubic metre of stuff passed through the sluices.

The ancient workings in the neighbourhood were not confined to the easily handled slates and gravels of the river-beds of Ajedrez. The Indians talked so much superstition and weird nonsense about Cavaloonga mountain that I determined to visit it. They said "the mountain was the source of all the gold in the Rinconada hills and valleys; that it was the great 'mother of gold' of the district, and contained riches so great that, when once found, avarice would be dumb; but the place was haunted by the spirits of the dead Spaniards buried in the workings more than a hundred years ago." The mountain is one of the giants of the Santa Catalina range; it is about 16,500 feet high, and

lay about 5 miles to the south of our camp. One long day from daylight to dark was occupied in getting to the top and back to camp. But it was one of the most interesting days I ever spent. The weather was clear and fine, and the climb was exhilarating; the views, once the summit was attained, were magnificent, for the top was the highest peak for 20 or 30 miles round, and a panoramic view for 100 miles or more could be obtained in every direction. All the vast plateau lay below us like a map to the east and north-east, with its rivers, river-beds, lake-beds, salinas, single hills, chains of hills, and mountain chains clear and distinct. Granada, lightly snow-tipped, 20,400 feet high, showed to the north-west about 25 miles distant, and seemed only 5 or 6 miles away; to the north, in Bolivia, in the main chain of the Cordilleras 50 or 60 miles distant, and from 20,000 to 23,000 feet high, Bonete, Estarca, and San Antonio, snow-capped, sparkling, and sunlit, looked like piles of molten metal. The Oromayo river and Ajedrez were just below us; the huge salinas in the province of Salta and the Puna de Atacama lay in the far faint distance to the southward. It was a glorious day and an incomparable view.

The ascent of the mountain was easy from the northern side. The formation was slate on edge, the greater bulk heavily decomposed; in some cases the highly decomposed slates were soft as running sands. On the way up I noticed a few quartz outcrops each over a yard wide; some were very unpromising in appearance, but two or three were of nice-looking stone. On the extreme summit of the mountain there were traces of old workings, very much fallen in and covered. About 150 feet below the summit of the mountain to the east there were three large dumps. The dumps must have represented mullock taken from galleries or shafts to the extent of over 100 yards long in each case. The dumps were composed of nothing else save soft slate; a few small pieces of quartz only were sparsely scattered on the surface, and almost every one had a nice speck or two of gold in it. It is reasonable to assume that any other gold-bearing quartz taken out of these workings was carried away. In each entrance to the workings a wall was built up on either side, and roofed over with dry-laid stone slabs to form a permanent entrance, and stone steps led down into the workings. But the dry rubble masonry of the passages was squeezed, and the passages narrow, fallen in, and impassable after 5 or 6 yards from the entrance. So I could not see any of the "buried treasure," nor the "bones of the dead Spaniards;" but undoubtedly very extensive works had been in progress there, over 16,000 feet above sea-level, in a past time of which, locally, nothing is now known.

After thirty-three days spent in travelling about the Rinconada district, my route lay southward. Towards the southern end of the Laguna de Guatayoc I passed the great borax fields of that locality. A very small part of these was being worked, but the visible evidences

A VIEW IN THE FAMATINA MOUNTAINS (ABOUT 15,000 FEET ABOVE SEA-LEVEL), SHOWING THE CONTOURS OF THE HILLSIDES.

THE BORAX FIELDS OF THE LAGUNA DE GUATAYOC (ABOUT 10,000 FEET ABOVE SEA-LEVEL). DEPARTMENT OF JUJUY, ARGENTINA. SHOWING THE BORAX DUG FROM CLOSE BELOW THE SURFACE AND PILED IN HEAPS TO DRY.

were immensely fascinating of the vast wealth of borax lying close under the crust of the salina; so closely at hand that nothing was required but to dig it up, and I felt loath to leave the place to continue my journey. Sometimes deposits such as these are spoken of as "borax mines," but are not mines in the ordinary sense of the word; they really present agricultural rather than mining problems. The vast flat earthy surfaces of the salinas beneath which the borax lay lost themselves in extreme distance or mirage, and to all appearance any one square yard of such places was similar to any other part. Perhaps it was so; but wherever the crust of the salinas in the locality of Tres Morros or Moreno had been dug into 12 or 14 inches deep, there lay masses of soft white round "potatoes" of borax, packed closely together to a depth of about 18 inches. The digging of the borax was just like the digging of potatoes, and the borax "potatoes" were stacked in rows on the ground, just as freshly dug potatoes on a farm are laid in rows; only an area of borax ground held perhaps five or six times as many borax "potatoes" as the same area of an agricultural field generally contains of the potato of domestic consumption. The lumps of borax varied from the size of a hen's egg, to pieces of 1 and 2 cubic feet in size. They lay close below the surface, and when broken were soft looking, like moist snow. After lying in rows on the surface, and subject to the intensely drying winds that swept over the plains at these high altitudes, the wet snow colour became white like pure dry clean snow, the lumps became hard, and the weight diminished more than half, by reason of the evaporation of the mechanically held water; the wind-dried borax then contained about forty-five per cent. of pure boracic acid. In some places these salinas were so rich in borax that it lay in unbroken seams 15 to 20 inches thick close below the earthy crust of the surface. For nine months at least of every year the borax fields are workable, and for the remaining three months they are either under water while the salinas are flooded in the wet season, or the surface has not dried sufficiently, and is too soft for men or vehicles to work on it or travel over it.

I followed the plateau southward for nearly seven days from Rinconada without any appreciable fall in altitude, until I wondered when the drop would begin, for the town of Salta lay some 8000 feet below our road. One awful day we travelled through a dry wind storm, which began about 10 a.m., and lasted into the evening, long after we reached camp. The wind blew continuously and gustily, with force that lifted stones as large as road metal, and carried such quantities of sand and grit that the day at times was almost dark. Fortunately, the storm blew in the direction we were travelling, otherwise it would have been impossible to move. The effect of the wind, dust, and grit on our eyes, and on the eyes of all the animals, was most severe, and its unpleasant results lasted for a day or two afterwards. On the seventh day

out from Rinconada, a little south of Tres Cruces, at the height of about 11,500 feet, near some lagoons covered with water-fowl, on the eastern edge of the plateau, the road and a stream from the lagoons led into a ravine that speedily became a cañon; for although the road sloped steeply downwards every foot of the way, the top of the cañon on either side remained practically the same level, and the walls became very precipitous. The fall continued more or less regularly 50 or 60 miles down the "Quebrada del Toro," until Rio Blanco and the plains surrounding Salta were reached, where the altitude was about 4000 feet above sea-level.

After leaving Salta I next visited the province of La Rioja, a place remarkable for several reasons. For many years it had been considered the Cinderella of Argentina, but recently the Provincial and National Governments have endeavoured to provide facilities to take advantage of its vast natural resources, which are of sufficient importance to give promise that it will soon join the great wealth-producing provinces of Argentina. The province holds two important ranges of mountains, marked on only two or three of the published maps of South America. The Famatina range is the more important of the two; it is a spur of the main Cordillera, which it leaves at about S. lat. 26° 40′ and continues in a south-easterly or southerly direction to about S. lat. 30° 10′. The main peak, named Famatina (*fama*, "fame;" *tiene*, "it has"), is 6400 metres high (20,997 feet); it does not stand peak-like in any marked degree, for the chain itself close by is over 18,000 feet, and its surrounding peaks are about 20,000 feet above sea-level. Snow always lies in heavy patches on the more sheltered spots on the peaks and higher parts of the range, but no cap of eternal snow is there such as might be expected from the altitude. About 50 miles eastward of the Famatina range, the Velazco range rises from the plain, at lat. 28° 20′, like an island from the sea, and after continuing almost due south to lat. 30° (about 120 miles) disappears as suddenly as it began. The Velazco mountains are almost entirely composed of granite, and for the greater part of their course average a height of between 10,000 and 12,000 feet above sea-level; no peak much higher than the chain is noticeable in their contour.

Between the Velazco and the Famatina ranges lies what is known as the desert of La Rioja—a wilderness of stones, cacti, dry spiny things, with stunted shrubs, and forests of timber, all guarded by thorns as sharp as lancets. There are no lakes in this locality, and, indeed, no rivers. To understand one of the reasons of this it is necessary to explain the geological conditions, the main features of which are similar in every case, whether they refer to high mountains, or only little hills a few feet above the surrounding plains. At one time the surface of the country must have presented high ranges of mountains with sharp peaks and sharp chains of hills, all with deep-pointed

valleys between. But deep-pointed valleys no longer are there; for, being a land where great differences of temperature, high winds, and other destructive elements were constantly present, the mountains and hills weathered, and filled the steeply sloping valleys level with the products of decomposition, and the running water was not strong enough to move them away. To-day comparatively level plains surround all the hills and mountains, and these present straight, hard, torn, and jagged outlines—the spurs with fine razor-backed edges, and the summits like sharp needle-points. There is practically no clay in the locality, and the soil of the valleys is highly porous. In every

THE FAMATINA MINES, SITUATED FROM 13,000 TO 17,000 FEET ABOVE SEA-LEVEL, DISTANT FROM CHILECITO 25 MILES. THE TERMINUS OF THE GOVERNMENT AËRIAL RAILWAY WILL BE IN THE BOTTOM OF THE VALLEY, ALONGSIDE THE HOUSES SHOWN IN THE RIGHT-HAND CORNER OF THE PHOTOGRAPH. NOTE THAT THIS PHOTOGRAPH WAS TAKEN FROM A POINT ABOUT 19,000 FEET HIGH.

main valley coming from the mountains there is something in the nature of a mountain stream, that may follow its tortuous bed for 10 to 20 miles in length until it eventually reaches the plains, and then assuredly, after 2 or 3 miles are traversed, it loses itself completely. But it is almost certain that underneath the large stony beds of the valleys leading from the main chains of mountains, there flows somewhere a constant stream of water. Though the country generally is deficient in rainfall, there are certain seasons of the year when rain falls heavily and frequently. There are falls of snow on the higher mountains, but the winds are usually intensely dry, so it frequently

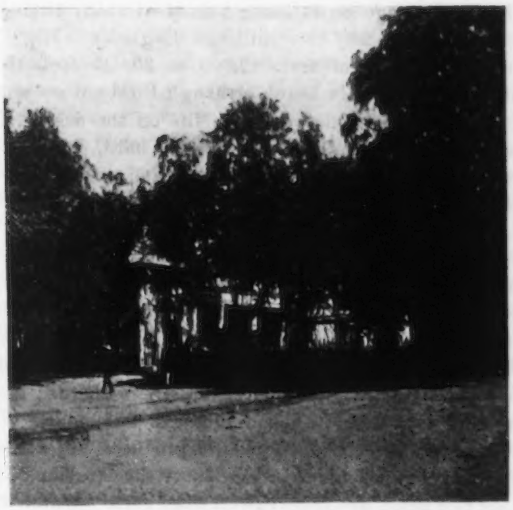
happens that a heavy fall of snow one day will before the next have completely disappeared, without adding any perceptible volume to the flow of the water in the streams. The headwaters of most of the streams are black, blue, green, or yellow in colour, and so highly are they impregnated with the salts of copper, silver, and other metals, that even tired mules, without water for two or even three days, refuse to drink of them. It is only far away from the sources of these streams, after they have been augmented in the lower hills by pure water-flow from hundreds of gullies, that the bitterness of the water becomes so diluted as not to be noticeable, or deleterious to animal or vegetable life. Occasionally heavy torrents of water pass down the valleys carrying rocks and stones with them, but for almost all the year they are dry, except for small streams that find a channel amongst the dry rocks and stones covering their wide surfaces. The effect of the occasional torrential waterflow was very marked, though only noticeable from a distance, and more particularly from some neighbouring mountain-top. Seen from either point of view, it always seemed as if from out of each ravine a mighty river were sweeping, eddying and roaring into the main valley, carrying everything before it; and yet, these places were only dry, arid, motionless, stony wastes.

The rocks of the foothills and lower ranges of Famatina are chiefly granite, and very remarkable amongst them are the conical hills of rosy-red iron-stained granite, looking like piles of bright red rust poured from some overhead shoot on to the plain, making a strong contrast to the chocolate-brown-grey background of the foothills. The grey granite rocks continue up to the height of about 10,000 feet, where slates begin. The slates are then continuous almost up to the peaks of the Famatina range; occasionally porphyry dykes, a little limestone, and some conglomerate rocks occur, but slate and metamorphic slate are the typical rocks of the Famatina range, and also of the Mejicana and other of the principal spurs that lead down from the main range. In climbing near to the summit of Famatina, at an altitude of between 19,000 and 20,000 feet above sea-level, I noticed that grey and a little rosy granite covered the surface, but whether these rocks extended to the top of the peak of Famatina I am unable to say, because I turned to the southward on to one of its neighbouring peaks about 20,000 feet high; but even there slate was the prevalent rock. I could not find any fossils, nor did I hear of any having been found in the locality. The rapidity with which the mountains weather and break down, both in La Rioja and in the northern provinces I journeyed over, is one of their most striking features. The sides and tops of the mountains are almost always covered deeply with a sheet of broken stone moving imperceptibly into the valleys. It moves so fast that it buries and blots out, almost like a fall of snow, any works which man may make on the hillsides and leave neglected for a few years. I have even seen entrances

to tunnels buried and almost invisible after having been abandoned for less than a year. In all the slate formations the disintegration proceeds with very great rapidity, and the granite also weathers quickly.

The Indian has almost entirely disappeared from this place, and the inhabitants are mainly the descendants of the early Spanish settlers, who peopled the country from the west coast; and since the railways have been built into North-West Argentina, a large population of Europeans has settled there.

The animal-life in the mountains of La Rioja differed materially from that described in the northern part of my journey. The guanaco took



THE RIOJA DESERT RECLAIMED. MR. W. A. TRELOAR'S HOUSE AND GARDEN NEAR CHILECITO.

the place of the vicuña, and no llamas were to be seen. The tucutuco was not there, neither was the chinchilla. Herds of deer were in the valleys more remote from settlements, at altitudes between 3000 and 10,000 feet. There was also a large long-legged hare, or what is called a hare, but not having killed any of these animals I am unable to describe them. The large grey fox and the small grey fox were common, but the black-and-tan fox was very scarce. Mules and donkeys were used mostly as beasts of burthen; the horse was also used, but was not so useful in the mountain. There were many horned cattle, chiefly fed upon artificially grown alfalfa (lucerne). Sheep and goats were plentiful; these usually grazed upon what they could find edible and unprotected.

Bird-life was not much in evidence. Occasionally pigeons were seen on the desert, and a few doves on the desert and in the hills up to about 5000 feet; also in the hills a green and red parrot, nesting in holes, in the earth banks of cañons and rivers; a colony of them made a noise like young rooks in an English rookery. Now and then a brace of partridges were flushed; these were the long-necked, long-billed variety common in South America. Few duck or water-fowl were seen; occasionally a couple of duck came down on to one of the sweet-watered mountain streams. The carrion hawk and the vulture were very commonly seen, and occasionally the condor; but this bird is becoming scarce, owing to the constant warfare that has been waged against it, its skin with the plumage on it being valued at about twenty to thirty dollars (thirty-five to fifty-two shillings English). High up in the mountains, at altitudes of from 12,000 to 20,000 feet, the calls of ptarmigan were continually heard, although I did not see any of them.

There was practically no vegetable life on the desert of La Rioja beyond cacti and thorny and spiny growths, hard, dry, and repellant. The trees sometimes grew as large forests, and were characteristic of the country and the vegetation—gnarled, rugged, and strong, grown into distorted shapes, but neither wide nor shade giving. The wood was dense and heavy, and of high calorific value, and burned with little ash. But even the limbs of the trees were all covered with sharp, lance-like thorns.

The most remarkable characteristic of this solemn, stern, and forbidding desert is that man can, when he chooses, turn it into as nearly an approach to a paradise as this earth anywhere affords; and water is the magic wand that with its touch produces fairyland. With water the extraordinary and immediate results produced are almost beyond the powers of imagination. The stories of the Arabian Nights, with the good and evil genii, are there in everyday garb. Water the ground, and a natural garden springs into life; cut off the water, and almost in a night it relapses into the grim, sterile, life-stifling desert. I can best instance the fertility of the land by describing one of the many oases which man has made in this locality, and take for example the quinta of Mr. William Alfred Treloar that lies close outside the town of Chilecito, at the foot of a granite ridge sticking out of the plain. There Mr. Treloar located himself some thirty-three years ago. He had travelled hundreds of miles over the dry thorny deserts to some mines in the Sierra Nevada near Chilecito, but there at the "Carrera" on the edge of the desert, among the dry barren shrubs, cacti, and rocks, he decided to make his home, for a little trickle of water had made some things green. From some 7 or 8 acres he gathered the stones to make his outside walls, and his house was built on others for its foundation, while its walls were of unbaked bricks and mortar made from the Earth's surface, puddled up with water, so little by little the home grew.

Broad spreading trees shaded the place; oranges, vines, peaches, figs, apples, pears, roses, lilies—fruit, flowers, vegetables, everything that one could conceive to be necessary for the wants and luxuries of man, seemed to be produced from these few acres. Gardens with shaded walks, and leafy bowers perfumed with thousands of flowers of all descriptions, amongst which butterflies and humming-birds flitted, whose hues were more dazzling than the blaze of colour from the flowers. Every tree he planted himself and saw grow, every flower or bower was grown or trained under his direction; small water-channels intersected the garden everywhere, and that and care were the secrets of the magic change from without the walls, where the dry prickly desert with its cacti and thorny plants and sand and stones disfigured the face of the Earth. The same desert stretched for thousands of square miles around this and similar oases; but throughout the vast desert the same bountiful plenty could be obtained were it treated in like manner to this garden, and the other gardens and vineyards of Chilecito and Nonogasta near by. For instance, in Mr. Treloar's vineyard, covering some 5 or 6 acres, a small tram-road ran up the middle. I asked what that was for, and when told that it was to bring the grapes to the wine-press, I wondered why they were not carried in baskets; but when I learned that off these 5 or 6 acres some 80 tons of grapes are gathered each year, I ceased to think of the tramway, and my wonder was turned to the marvel of the Earth's productiveness. Eighty tons were the average net yield, after house servants, farm and garden servants, and peons who drive troops of mules up and down the mountains with ores from the mines, had eaten their fill, and the house dogs, and the dogs of the servants and peons, and also a vast number of the little silver-grey foxes who crowded in yearly from all corners of the desert during the grape season, and birds who came from all places. There was enough and plenty for all of these, and then 80 tons besides. Natural prodigality pervaded the atmosphere surrounding Chilecito; wild asparagus of most delicate flavour flourished everywhere in the vineyards; peaches blossomed and produced lavishly wherever a peach-stone had fallen and was allowed to become a tree; poplars, and trees half poplars, half willows, shot up like beanstalks 35 and 40 feet tall in three or four years, and in twenty-five to thirty years grew to huge trees of unbelievable height, that broke cold and hot wind storms, and threw grateful but not stunting shade upon the vegetation near them. And in this wonderful atmosphere, with the surpassingly beautiful Velazco range 25 miles away in front of his quinta, Mr. Treloar tended his garden and followed his hobby. His business lay at the mines somewhere up near the clouds, at Famatina—indeed, I believe some of them are the highest mines in the world; down on the desert's edge was where he played and kept open house for all friends and visitors, rich and poor. Far over the desert, thirty years ago, he sent

his ores to be carried to the port and to Europe, until, four years ago, the rail-head reached Chilecito, just on the other side of the ridge alongside which his habitation has been fixed.

Large tracts of desert in the locality have been reclaimed—cleared of thorns and stones and irrigated — and on these vine-growing flourishes; but the results so far are more excellent gastronomically than commercially. Up to the present Chilecito wine has not made the market it deserves in the Republic, and, as far as I know, Argentine wines have not yet found much place in the markets of Europe; but of all the very excellent locally made wine which I tasted in various vine-growing districts of Argentina, that grown on the desert of La Rioja was by far the most palatable.

The real industry of the department of Chilecito has up to the present been mining, and it is that which will probably bring the province into world-wide fame, and cause vine-growing and the general tending of the soil to follow in its train. This place Chilecito was settled from Chile during the time of the Spanish occupation, because of the richness of the Famatina mountains in silver, gold, and copper. Millions of ounces of silver have been taken from the Cerro Negro, that lies at altitudes of from 8000 to 12,000 feet above sea-level, close below the peaks of Famatina; and higher above the silver are the great copper-silver-gold mines of Famatina in the Mejicana spur. To these last the Argentine Government are now building the largest aërial railway in the world, so as to connect them with the Government railway at Chilecito. In the earlier days of the recent history of these mines, the ore was sent over the Cordilleras into Chile on the backs of mules; later it was carried for more than 300 miles across the deserts, either on mule-backs or in carts, until it reached the waterways of Eastern Argentine; and later still, after the big company railways had been built northward through the Republic, the Government pushed a mining railway westward, in order to tap the riches of the province. The recent history of the Famatina mines extends for some thirty years, and during that time ore to the value of over three millions sterling has been taken from them, and yet they may only be considered in their infancy. Records obtained from the smelters of 35,000 tons of ore treated in the local smelting works during the past few years show that the average value was £10 18*s.* 10*d.* per ton of ore. The Argentine Government expects that when the new railway is finished, about next October, connecting the mines with Chilecito, the district will take the lead in the mining industry of Argentina, and that a large population will follow, to work the mines, or take advantage of the extraordinary natural fertility of the soil.

My other journeys through Argentina were in places better known than these I have roughly sketched; nevertheless it is not an exaggeration to say that, outside the main roads and railways, very little is known,

save locally, of that truly wonderful country overflowing with milk, honey, corn, wine, oil, and riches that the hearts of men desire.

Before the reading of the paper, the PRESIDENT said: I have the pleasure of introducing to the meeting the reader of the paper, Mr. O'Driscoll, who will give you an account of the very little-known part of the Cordilleras of the Andes, or rather two parts, one near the frontier of the Argentine Republic and of Bolivia, and the other somewhat further south. I will now ask Mr. O'Driscoll to address you.

After the reading of the paper:—

Colonel CHURCH: Mr. O'Driscoll has this evening shown us views over some of the tramping grounds of my youth. He has gone a little further to the north-west than I travelled, but where he left the country to the north I went immediately northwards up the Rio Grande branch of the Humahuaca and reached Peru by the way of Bolivia. Well do I remember that river; I never want to see another like it. For 250 miles up its boulder-covered bed it was nothing but jagged rocks. You may judge a little of the character of the riding when I tell you I forded it on one day fifty-one times. Such is the character of the country that the river is hemmed in by lofty mountains such as have been shown you this evening. One finally emerges from the headwaters of the stream and reaches the tableland of Bolivia. All this country was a portion of the southern outpost of the Indian empire, and I am a little disposed to differ from Mr. O'Driscoll that all of its mines were opened by the old Spaniards; I think the Incas got a great deal of the copper that they used for instruments from that very district. Moreover, the slopes of these mountains were the scenes of many hot contests between the Inca army and the Chirihuano branch of the Guarani tribes of Paraguay. What we have seen to-night is a country which is destined to become an enormously productive mineral district. It is probably one of the richest copper fields in the world, and the fact that the Argentine Republic, with that energy which characterizes its people, is now turning its energies to its mineral wealth is a very good sign, and it must increase the prosperity of that wonderful land. It attracts attention almost equal to North America, and certainly, in proportion to its area, its million square miles ought to produce in varied products as much as any other million square miles on the surface of this Earth.

Dr. EVANS: We are much indebted to Mr. Florence O'Driscoll for his graphic account of a journey through very interesting country. It is about fourteen years ago that I first met him very nearly in the centre of South America, close to the borders of Brazil and Bolivia. At that time he, like myself, was a new-comer in the South American continent, but he has made good use of his time since. He still, however, seems to find it hard to reconcile himself to the Spartan fare of the wilderness. I was especially interested in his account of the system of wire transport. There are many regions in the Andes, both of Bolivia and Peru, which can only be opened up by the use of that means of locomotion. I was also glad to hear of the progress of the railway northward into Bolivia, and I look forward to the time when we shall have a continuous railway service from Buenos Ayres to the Caribbean sea. All those interested in the South American continent look with envy on the great railway network of North America, and hope some day to see something like the same state of things in the south.

The PRESIDENT: We have to thank Mr. O'Driscoll for an interesting paper respecting the country which he has described most admirably both by his lecture and by his illustrations. The meeting will have noticed that he described two regions very distant from each other; the first being the Sierra de Santa

Catalina which I think peculiarly important from a geographical point of view, because here, or very near it, the three ranges of Peru become the one range dividing Chili from Argentina and running down into Patagonia, and that particular portion of the Andes is very little known indeed. This is the first time I have met with a traveller who has ever visited those heights of the Sierra da Santa Catalina, and, so far as I remember, I know of only one who has ever gone over that country as a traveller into Bolivia. There is an account of a young lady, living in the seventeenth century, who stole her aunt's scissors while she was in church in St. Sebastian in Spain, stole her keys, escaped out of a convent into a little wood, and there turned her novice's clothes into a boy's clothes, went and hired herself on board a ship, and went out to South America. She there entered as a private in the Spanish army, did good service, and gained a commission as ensign. Then she had the misfortune to kill another gentleman in a duel—having killed three or four others before—and she had to run for it. She appears to have gone over that very pass, and to her great joy she saw two men sitting on a stone, and felt sure she would get some food from them, but when she got near she found they were both dead, with nothing in their pockets except money, which was no good up there. Then she made her way down to Tucuman, living on roots and *tola*, and there she was most hospitably received by a Spaniard. But she began making love to his wife; the Spaniard was furious, and she had to go. She was chased by the infuriated husband, so she turned to the left and crossed the Sierra de Santa Catalina, all that time for hundreds of miles living on roots and *tola* and small rodents. How she could possibly have gone over that country by herself is most marvellous, but it is perfectly certain that she did so, because there is documentary evidence of the journey. Now, that young lady is the only person I have ever read of who has travelled by that Santa Catalina route to Potosi alone. I need not relate the end of the young lady; and I only mention the story here to show how very few persons have travelled over the route. I am sure we are deeply indebted to Mr. O'Driscoll for the admirable description he has given of it, and especially of that very rich mining region, and for the graphic way in which he has described to us the mountains and mountain district of Rinconada. I am sure that the whole meeting will join with me in giving a cordial vote of thanks to Mr. O'Driscoll for his paper.

REPORT ON THE WORK OF THE AMERICANIST CONGRESS AT STUTTGART.

By the PRESIDENT.

THE Fourteenth International Congress of Americanists, under the presidency of Prof. Karl von den Steinen of Berlin, was opened at Stuttgart by the King of Wurtemburg on August 18. Our Society was represented by the President; and among geographers and travellers there were H.R.H. the Princess Therese of Bavaria, PHIL.D., Le Duc de Loubat, Dr. Reiss, Dr. Baessler, Dr. Boas of New York, Count Rosen of Stockholm, and the Count de Créqui-Montfort, all distinguished for their American travels and researches. There were also present Dr. Haring, the Rector of the University of Tubingen, Prof. Hamy (Membre de l'Institut), Dr. Holmes, the Chief of the Bureau of Ethnology at

Washington, Prof. Seler of Berlin, Dr. Thalbitzer of Copenhagen, Dr. Yngvar Neilsen of Christiania, and Jonkheer L. C. van Panhuys of the Hague. Of the Spanish-American States, Argentina, Mexico, Peru, Chile, Bolivia, Ecuador, Guatemala, and Nicaragua were represented by delegates.

As the work of the Congress of Americanists embraces geography, as well as anthropological, historical, and antiquarian researches, it is right that our Society should accept the invitation to be represented at it, and that we should be furnished with a report on its proceedings from a geographical point of view.

Our Scandinavian colleagues called our attention to questions relating to the Normans in Greenland, and to the Eskimo. The point of Dr. Yngvar Neilsen's paper was to establish the fact that natives met with by the Normans in America, in the twelfth century, were Eskimos, and not Indians; and Dr. Fischer gave illustrations of the cartography of Norse discoveries in America. From Prof. Stolpe of Stockholm we had a paper on the Eskimo of North-East Greenland; and Dr. Thalbitzer addressed the Congress on the dialects and migrations of the Eskimo. Shamanism among the Chukchis was discussed by Dr. Bogoras of Moscow. These five communications, from their different points of view, represent a distinct advance in our knowledge of the history and movements of the Eskimo race. Dr. Boas, whose excellent work on Baffin island is well known, took part in the discussions; his own paper being on recent researches respecting the Vancouver Indians.

But little time was devoted to the North American Indians, but Mr. Currier, the Vice-President of the Catholic Seminary in Maryland, had a paper on the Indian languages in the United States. Dr. Sapper of Tubingen contributed an interesting paper on the Pokonchi Indians.

Jonkheer L. C. van Panhuys, an official in the Colonial Office at the Hague, and Dr. Schmeltz of Leyden, contributed papers on pictography in the Dutch Antilles, on the ornaments of the people of Dutch Guiana, and on a recent expedition into the interior of Surinam.

Mexico always has a large share of the attention of Americanists. At the present Congress there were seven Mexican papers on mythology, customs, sacrifices, hieroglyphic writing, and ornamental art; none having any bearing on geography.

As regards South America, most of the papers were of more general interest. Such was Dr. Meyer's memoir on the equatorial Andean region before the existence of man, which contained speculations on the glacial and inter-glacial periods with reference to the distribution of flora and fauna, and on the periods of volcanic activity in Ecuador. Dr. Baessler of Berlin contributed a most valuable paper on the ancient use of metals in Peru; and on his treatment of Peruvian mummies with all their outer wrappings, by means of X-rays, which enable him

to see the skeletons and any other objects that are within the wrappings. This paper was illustrated by lantern slides. The archæological researches, made by Count Rosen, the companion of Baron Erland Nordenskiöld during his expedition on the frontier of Argentina and Bolivia in 1902, are very interesting. Unfortunately, Count Rosen was obliged to leave Stuttgart before the paper came on for reading, but he has had it printed in pamphlet form in English. There is clear evidence that the regions round Tarija and Jujuy were once very densely peopled.

The President's paper on the megalithic age of Peru was intended to raise some questions of geographical importance. He set forth the reasons for assuming the immense antiquity of an advanced stage of agriculture and of the domestication of animals in the Peruvian Andes. He arrayed all the evidence that the marvellous builders of the Tiahuanacu ruins near Lake Titicaca came from the south—from the once populous regions of Tarija, Jujuy, and Tucuman. He then quoted numerous authorities to prove that the ruins are of immense antiquity, that they were in the same condition in the time of the Incas as they are now. He set forth not only the excellence of the architectural workmanship at Tiahuanacu, but also the evidence that the builders were capable of recording great ideas by sculptured symbolical representation. Finally he showed that such work, and the movement of monoliths weighing 170 tons, necessitated the existence of a dense and well-organized population, requiring the provision of immense supplies of food. For Tiahuanacu is 12,930 feet above the sea, where corn will not ripen. The two geographical questions raised by the paper were the changes of levels of Lake Titicaca with regard to the site of the ruins, and the supply of food for a dense population living at 13,000 feet above the sea. The author ventured upon some suggestions to account for facts so difficult of explanation.

The President's paper was followed, on the same day, by a most important report on excavations at the Tiahuanacu ruins, by the Count de Créqui-Montfort, the leader of a French mission. In the course of his excavations the Count discovered an outer wall previously unknown, a stone staircase, vestiges of several colours on sculptures and pottery, and statues. The Count de Créqui-Montfort also communicated a report on the examination of a Peruvian necropolis; and gave some information respecting the little known country of Lipez and Atacama.

There were two more general papers, one on the myths and legends among the primitive people of South America and their dissemination, another on the actual state of exploration in South America and on a programme for the future. The latter subject is one which may well engage the attention of our own Society, for with the exception of the Antarctic regions, there is more unknown or little known land to be explored in South America than in any other part of the world.

Two interesting papers, one on the discovery of a globe of Gemma Frisius with the date 1537, five years earlier than Mercator's globe; the other, on the influence of magnetic variation on the cartography of America in the sixteenth century, must also be mentioned.

The Congress at Stuttgart has been a success, both with regard to its results and socially; and Prof. von den Steinen, and his supporters, are to be congratulated heartily on the good work that has been achieved. Much of the success was due to the efforts of the Count von Linden, and of the treasurer, Mr. Wanner. The number of Americanists present at the Congress was 380, number of papers read 40. It is understood that the next Americanist Congress is to be at Quebec.

DESCRIPTION OF AN ASTROLABE.

By S. A. IONIDES, B.A.

It is well known that the astrolabe is an instrument which dates back to ancient times. Its invention is ascribed to Hipparchus (B.C. 150), and its subsequent development to Ptolemy (A.D. 130) and the Arabian and Persian astronomers. A great advance in its use was due to Martin Behaim, of Nuremberg.* It continued in practical use for two centuries or more, till superseded by the quadrant, or sextant, and logarithm tables (for it combined the uses of both), at the beginning of the eighteenth century. It is said that examples are made in the East to-day for astrological purposes.

There are several books and papers describing the astrolabe. First, both in time and importance, is Chaucer's description in 1391. This is now made easily accessible in Prof. W. W. Skeat's edition (1894). It contains a full description of the instrument, and the multifarious uses to which it can be put, and Prof. Skeat has added notes and explanatory diagrams. In 1587, Robert Tanner (gent. practitioner in Astrologie and Phisick) published in London a work entitled 'The Travellers joy and felicitie; or A Mirror for Mathematics, Golden Gem for Geometricians, A sure safety for Saylers, and an Auncient Antiquary for Astronomers and Astrologians.' The first chapter contains a description of the astrolabe with diagrams, and thirty-one other various uses to which it may be put. In 1856 W. H. Morley published 'A Description of a planispheric Astrolabe made for Shah Husain Safawi, King of Persia,' which contains facsimile reproductions of a large Persian astrolabe in the British Museum, and of others, and gives a very full description of the parts. The issue was limited to one hundred copies, and is long since out of print. In 1894 Lady Huggins published a

* The exact share to be ascribed to Behaim in the introduction of improved methods is matter of doubt.—[ED. *G.J.*].

short article on the Astrolabe in 'Astronomy and Astrophysics.' It contains several excellent photographs and drawings of an oriental astrolabe, a historical summary, and several quaint references to its use in contemporary works.

None of these books, and none of the papers to which references will be found in the short bibliography at the end of this paper, give any account of the theory of the instrument, and many discuss it almost entirely from the archæological point of view.

When, in December last, I was fortunate enough to come into possession of an astrolabe, Dr. H. N. Dickson suggested to me that it would be of interest to describe the instrument, and to give in a concise form some account of its theory and uses.

This astrolabe is inscribed—

"GEORGIUS HARTMAN NORENBERGE,
FACIEBAT ANNO MDXXXVII."

The date is interesting as being six years before the publication of Copernicus' great work, 'De Revolutionibus Orbium Celestium,' in 1543. At South Kensington there is one, and at the British Museum there are two, by the same maker. No essentially different features have been noted in any of them. This description, while applying in particular to a Hartman astrolabe, is applicable to all in general, as the principles involved in all appear to be the same.

The photographs which accompany this paper show all the working parts of the astrolabe. The main part is a brass disc engraved with scales, and hollowed out on one side, the hollow being called the moder of the astrolabe; the instrument is held by a ring attached to the disc.

The separate parts are the alidade for taking sights, the "declination scale," the net, and the "latitude plates." These last are stored in the moder of the astrolabe, and only the upper one shows in the photo. The parts are pivoted on a brass centre, and kept in position by a split pin. On the brass centre and on the handle which holds the ring are engraved Tudor roses—the same being found in the South Kensington example—and this, taken with the fact that they were made in the reign of Henry VIII., and were found in England, suggests strongly that they were made for English use, possibly for presentation to some royal personage, or for use in the British Navy. The British Museum examples have roses on the handle, but not on the centres, one of which is obviously of subsequent manufacture.

On the back of the astrolabe are engraved in order, counting from the outside, a circle for taking observations, divided to single degrees, and numbered 0–90 from horizontal to zenith and nadir; next the names of the signs of the zodiac, each divided into 30 degrees; and then the names of the months and their divisions into days.

THE FRONT OF THE ASTROLABE.

THE BACK OF THE ASTROLABE.

These circles are so arranged that by laying the alidade across any date, the position of the sun in the ecliptic for that day can be at once found.

Inside these circles, and below the centre, are the squares of *umbra recta* and *umbra versa*. They are used for measuring heights and distances, and methods of using them are given in Skeat's Chaucer. The numbers on them closely correspond to the natural tangents (for *umbra versa*), and co-tangents (for *umbra recta*) of the angles read off at the same time by the alidade, multiplied by 12; thus in the photo—

$$\cot 63^\circ = 0{\cdot}509 \times 12 = 6{\cdot}072$$

while the reading of *umbra recta* is just over 6. This division cannot be strictly accurate, as the divisions on the straight line are equal, but up to the angle of 45° the variations do not become very serious.

Above the centre are six circles or portions of circles, one only being complete; their centres are found on the line joining the centre of the instrument to the centre of the handle, or its continuation. The purpose of the circles is not very clear, but if the points where they touch the inner circle be noticed, each division is equal to 15 degrees of arc, or is equivalent to one hour of time. The numbers might then correspond to the right ascension of the degrees of the zodiac, and through them to the right ascension of the sun.

Three heraldic devices complete the back.

Resting against the back of the astrolabe is the alidade, which is merely a ruler with hinged sights, and with a fiducial edge for making readings.

On the front of the astrolabe are engraved in concentric circles the twelve points of the compass, a circle divided into twenty-four hours, numbered 1–12 twice over, and a circle of degrees, numbered 0–90 from horizontal to zenith and nadir, and arranged to work with the hour circle, each degree of arc corresponding to four minutes of time.

In the moder of the astrolabe are first the net, which is simply a plan of the heavens on a stereographic projection with the north pole as central point. The tip of each of the twenty-seven pointers corresponds to a star of the first or second magnitude. The circle represents the ecliptic, with its twelve signs, 30 degrees being given to each, so that the position of the sun, moon, or planets could be utilized for determinative purposes, if their position in the ecliptic was known from an astronomical table. By setting the first point of Aries to 0 hr., the right ascension of each star could be at once read off with the ruler, and as this ruler also contains a scale of declinations—called *latitudo septentrio* and *latitudo meridio*—their declinations could also be easily obtained. By these means, and assisted by the names given to each star on the net, all were identified in the Nautical Almanac for 1903, and their positions calculated back by the precessions and proper motions

given there to 1537. The results obtained by calculation and by direct reading off the astrolabe were then compared, and it was found that while some agreed within a degree of arc of declination, and a minute of time in right ascension, generally variations up to 2 or 3 degrees of arc and 4 or 5 minutes of time were met with.

Below the net are the latitude plates—in this astrolabe three in number, and engraved on both sides. The latitudes for which they are engraved vary from 39° to 54°, 3° separating each plate. The main part of each plate is a stereographic projection of a sphere. The stereographic projection possesses the property that all circles on the sphere are reproduced as circles in the projection. These may be considered in two series. First, a series of nearly concentric circles; these are circles of altitude or almucantars, ranging in size from the horizon, the largest, to a dot representing the zenith. The altitudes are given for every 2°, and the circle for 18° below the horizon; the twilight line is also given. Secondly, a series of lines passing through the zenith; these are azimuths. One of them which passes through the point of projection is a straight line, and represents the meridian. The azimuths are given for every 10°, and are numbered from east and west, thus practically corresponding to amplitudes.

On each plate are engraved three other series of lines.

First, the tropics of Cancer and Capricorn, and the equator.

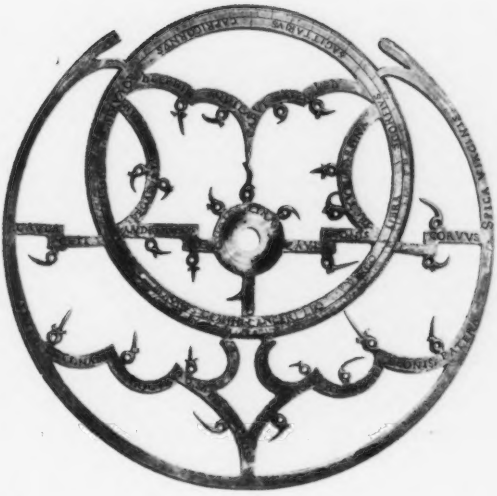
Second, twelve lines radiating from the intersection of the meridian and the northern horizon, and numbered I.–XII. According to both Chaucer and Tanner, these give the division of the heavens into twelve houses, "for divers astrological judgments." Prof. Skeat gives examples of how the equations of the houses were worked out.

Third, 12 lines marked 1–12 in the opposite direction to the foregoing. Segments of them only are given between the tropics of Cancer and Capricorn. They are stated to be the circles of unequal or planetical hours, or one-twelfth part of the time between sunset and sunrise, the division of the night in common use in early times. Pictorially they seem to represent the western horizon getting flatter and then curved in the opposite direction till it becomes the eastern. An account of them is given in Chaucer. The last two sets of lines cut the equator at equal intervals.

The practical use of the astrolabe may probably be best explained by taking imaginary examples and working them out, both on the astrolabe and by the ordinary methods now in use, the principles involved in both cases being identical.

To find the Latitude by Meridian Altitude of the Sun.—On October 19 the meridian altitude of the sun was observed to be 26°.

October 19 corresponds on the back to "Scorpius VI.," and on the front (see photo) the declination of the sun on that day was 13° S.



THE NET.

LATITUDE 51°.

Hence M.Z.D. = 64°
− decl. S. 13
Latitude 51°

The result could be tested by placing the correct latitude-plate in position, and putting "Scorpius VI." on the meridian. A similar calculation would be necessary in the case of a star, and the modern method is, of course, precisely similar.

Time by Altitude of the Sun.—On July 1, in lat. 51° N., the altitude of the sun east of the meridian was found to be 38°. Now, July 1 corresponds to Cancer XVIII. (see back). So Cancer XVIII. was set to altitude circle 38°, and with the ruler the hour angle of the sun, *i.e.* local (apparent) time, at once read off as $8^h\ 10^m$ a.m., the hour angle being always measured westward, and hence requiring no subtracting.

Giving the sun on that day the decl. 22° N., by the ordinary formula, hour angle sun = $3^h\ 45^m$, or local apparent time $8^h\ 15^m$.

Time by Altitude of Star.—On October 19, in lat. 51°, the altitude of Procyon east of meridian was observed to be 27°. The pointer marked "Procion" was set to altitude 27°, and its hour angle could have been read off, if wanted, as $8^h\ 11^m$. This was not, however, necessary, as with the position of the sun in the ecliptic at that date known, viz. Scorpius VI., the hour angle of the latter, *i.e.* the time, was read off at once as $1^h\ 12^m$.

To compute the mean local time from the observation mathematically, the declination must first be known. Procyon on the astrolabe has declination 9° N. Then, applying the ordinary formula ('Hints to Travellers,' 8th ed., p. 157), the hour-angle star was calculated as $3^h\ 50^m\ 40^s$; this subtracted from 12 hours gave westerly hour angle $8^h\ 9^m\ 20^s$. To obtain mean time, the difference in right ascension between the star and mean sun must be subtracted from $8^h\ 9^m\ 20^s$. The result is mean local time. The same process exactly is performed on the astrolabe, only graphically instead of by figures.

To find the True Bearing of a Heavenly Body.—By the same setting that gives the hour angle of the sun or a star, the true bearing can be found. Thus, in the example with Procyon, its true bearing will be seen to be 22° among the azimuth lines, the degrees being measured as mentioned from east and west. Chaucer gives the means of finding the true north from such an observation. Take the altitude and set the net as shown, read off the true bearing, then set the alidade on the back to the same degree, *i.e.* 22°, and, holding the astrolabe horizontally, sight the star. The handle will then point north or south according to which end of the alidade is used.

If the heavenly body be on the horizon, its amplitude is obtained at once; thus, in the photo the amplitude of Hydra Cor is 7° S. of E.

To obtain the true bearing from an observation of altitude, the

formula given in 'Hints to Travellers,' p. 207, may be used. The bearing of Procyon calculated by this gives 20° 40'; so that the astrolabe can give fairly approximate, though not always a reliable, value.

To find the Time of Sunrise or Sunset.—Set the point representing the sun on the eastern or western horizon as required, and read off the time (*i e* hour-angle of that point).

To find Time of Sunrise, April 17, *Sun at Virgo III.*—The net is set as in photo, and time $5^h\ 6^m$ a.m. read off. The duration of twilight may be similarly estimated by setting the sun to the horizon and reading the time, and then to the twilight line and again reading. The difference of the two gives the desired result.

Chaucer gives a description for measuring the length of the "vulgar" day, by taking the interval in time between the sun crossing the eastern and western twilight lines.

The time that any star is rising, setting, or on the meridian may be found by setting that star to the desired point, and reading off the time from the known position of the sun. For the ordinary method, see 'Hints to Travellers,' p. 220. The altitude of the sun or star at any given moment may also be found simply. Knowing the position of the sun, set it to the time required, and read off the altitude of the heavenly body. The ordinary method of making this calculation will be found in 'Hints to Travellers,' p. 191.

Many similar astronomical problems may be very simply solved by means of the astrolabe, and a few only have been given which show the capabilities of the instrument.

All the examples worked out have been taken from the astrolabe set in the position shown in the photograph of the front of the instrument, so that the results can be readily checked.

In considering the theory of the astrolabe, it must be remembered that it was originally constructed in days when all the universe was supposed to rotate round the earth, and it may readily be imagined that it was at first intended to show the *real* motions of the heavenly bodies. The fact that we now know that the universe does not rotate around the earth does not upset the theory of the instrument. It only converts *real* into *apparent* motions.

The net is an equatorial projection of a sphere, probably intended to be the *primum mobile*. The plates are projections of the same sphere, from the same point to the same plane, only the axis of the sphere is inclined at an oblique angle to that plane. The combination gives on a plane, what would be seen of two segments of spheres, rather larger than hemispheres, set one inside the other, with axes inclined, and looked at from the other end of the axis of one of them.

It is interesting to note how well this projection shows the apparent motions of the heavenly bodies. As the net is rotated, any one star-

pointer is seen to cross one altitude circle after another rapidly when far from the meridian, more slowly as it approaches it, reaching its highest altitude on the meridian, and receding in the reverse order.

Examples of the application of the astrolabe to ordinary uses have been given here, but for its many further uses, especially those relating to astrology, Skeat's Edition of Chaucer should be consulted.

The skilful design of the astrolabe is well worthy of note. Accuracy is not quite such a prominent feature, and one cannot be surprised that determinations of time at sea were often four or five minutes out, and that little reliance was to be placed on the resulting longitudes.

My best thanks are due to Dr. H. N. Dickson and to my brother, A. C. Ionides, for much assistance in the preparation of this paper.

Descriptions and illustrations of astrolabes have been found in the following:—*

Prof. Skeat's Edition of Chaucer (Clarendon Press), vol. iii. 1894.

W. H. Morley, 'Description of a Planispheric Astrolabe constructed for Shah Husain Safawi, King of Persia.' 1856.

Robert Tanner, 'A Mirror for Mathematics, etc.' 1567.

Archæologia, 1852, vol. xxxiv. p. 60. C. O. Morgan. It contains an abstract of Tanner's book.

Laussedat, 'La dessin topographique,' vol. i. pp. 35–40.

Transactions of the Bristol and Gloucestershire Archæological Society, 1887–8. Robert Taylor, M.A.

Astronomy and Astrophysics. 1894. M. L. Huggins.

Journal of the Royal Asiatic Society, 1904. H. J. Cowper.

RECENT DISCUSSIONS ON THE SCOPE AND EDUCATIONAL APPLICATIONS OF GEOGRAPHY.

By Dr. A. J. HERBERTSON.

It may prove useful to many readers of the *Geographical Journal* to present a very brief review of some of the more important contributions to geographical and educational journals, both home and foreign, dealing with the subject-matter of geography, and the value of the subject in an educational curriculum. It is necessary to discuss the content and method of geography before saying anything about its educational applications, for we must be perfectly clear about what we mean by geography and what is the specially geographical way of dealing with facts before we can profitably urge the importance of the former or the value of the latter to the schoolboy.

* See also figures in the *Journal* for June, 1903. Further references which may be of use in tracing the history of the astrolabe and other old nautical instruments are given by Dr. S. Günther in the *Geogr. Zeitschrift*, vol. iv. p. 157, and by Admiral Markham in the Hakluyt Society Edition of 'Davis's Voyages.' See also Gelcich in the *Hamburgische Festschrift . . . Entdeckung Amerikas*, vol. i.—[Ed. *G. J.*]

What is Geography?

In a recent lecture Prof. J. W. Gregory * defines geography as "that branch of knowledge which describes the Earth;" and maintains that "it is a branch of knowledge rather than a science," that its subject-matter is "description drawn from observation;" and that it does not "search for underlying principles," nor attempt to discover ultimate causes. Few geographers will agree with this account of their subject. Prof. Gregory seems, from his school books as well as from his lecture, to believe that geography is physiography plus a descriptive topography which cannot quite be confined to pure description, but "must sometimes glide into explanations." He seems to think that to admit more than this involves joining the ranks of a mythical school of geographers, who consider that "what is not geography is not knowledge." It may be that Prof. Gregory has encountered men in the fresh enthusiasm of geographical conversion, which reveals to them a new Earth, and for the moment the dazzling wonder of the vision has obscured all other sights. For them "Earth's young significance is all to learn," and the geographer is its interpreter. Such enthusiasm is, however, only too rare, and any temporary distortion of the relationship of the sciences which it induces is a little price to pay for the fuller, truer vision which afterwards comes. We hope that there are many earth-struck youths in the southern hemisphere. There are too few in this.

We have to contend daily with the misconceptions engendered by many a dreary ill-spent hour at school or, in the more intelligent, by a confusion between that excellent introduction to science which in this country is called physiography, and geography. Physiography is a useful introduction to geography, as it is to the other branches of science of which it treats, and as systematized nature study it is an invaluable school subject. It is not geography any more than it is geology, or astronomy, or physics, or botany. We fear that it is not the deep emotion of geographical inspiration, but the confusion of physiography with geography which has spread abroad the notion that geographers consider geology, etc., branches of geography. It is hardly necessary to controvert this conception.† The man who makes such claims is not a geographer, for he has not yet attained to an understanding of what geography is.

If we turn from Australia to Germany, we find in such a work as Prof. Wagner's 'Lehrbuch,' ‡ used in all the universities, the definition of geography is based on the historical development of the subject

* 'The Teaching of Geography.' A lecture by J. W. Gregory. Melbourne, London, etc. Whitcombe & Tombs. 'The Austral Geographies.' Same author and publishers.

† Historically, of course, geology is a daughter of geography, but now that it is full grown with a family of its own, it has its own sphere of influence.

‡ 'Lehrbuch der Geographie.' H. Wagner. 7e Aufl., I. Band. Allgemeine Erdkunde. Hannover u. Leipzig: Hahn'sche Buchhandlung. 1903.

as two-phased—one revealing the Earth as a special natural body with a variously shaped surface on which many natural phenomena, through orderly co-ordination, control the life of countless organisms, and the other showing the Earth as a dwelling-place of a highly organized and intelligent being, Man. The first phase is that of a natural science—Earth-lore—which is to be distinguished from other subdivisions by its constant investigation of the special relationships of natural phenomena on the surface of the globe. It is not restricted to an examination of the causes of the existence of simple organisms or processes, as is the case in many of the divisions of natural science, but strives to investigate the effects exercised by the various existences on other, or on the sum of the, contiguous phenomena. In the second phase, geography investigates man as dependent upon surrounding Nature, or as endeavouring to escape from this dependence. This is historical geography, and is the connecting link between natural science and history. For it, too, physical geography or Earth-lore is the basis and the extension, as it investigates the causes of the distribution of human phenomena. These may be regarded, as they have been from the days of Varenius, as general and special, Earth-embracing and regional. In Earth-lore the laws of the distribution of each and all categories of phenomena are examined for the whole Earth, without consideration of any special region. In land-lore or regional geography a single region is delimited from its neighbours, and its characteristics are determined by the total effect of the combination of all geographical elements within it.

Dr. A. Hettner, Professor of Geography at Heidelberg, has recently written a valuable paper on the fundamental ideas and laws of physical geography.* He frankly confesses how much he has been hindered by the lack of clear ideas about the limits and conceptions of geography. Geography has at all times been originally a knowledge of different parts of the Earth, at home and abroad, and only the point of view from which the space has been regarded has altered with the time and with the bias of the geographer. In ancient Greek and Roman times geography was concerned on the one hand with purely mathematical conceptions, on the other with the description of human concerns. Nowadays geography is a consideration of the lands of the Earth, and of the Earth as a complex of lands comprehending both nature and man, and may be defined as "the sum of the facts which constitute the lands and landscapes, or, in other words, the specially varying conditions and occurrences of the Earth's surface considered in their causal relations." Into the detailed consideration of Dr. Hettner's paper we cannot enter in the present communication.

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* "Grundbegriffe und Grundsätze der physischen Geographie." A. Hettner, *Geographische Zeitschrift*, 1903.

Baron von Richthofen's views are discussed at some length in the February number of the *Geographical Journal*.*

In France the definition of geography as the study of the Earth in its relationship to man is the common one.†

In America no book such as that of Wagner or Dr. Mill's 'International Geography' has appeared, but the newer school books still show the influence of Guyot in defining geography as the study of the Earth as the home of man. Several papers have recently been published. In the year-book of the (American) National Society for the scientific study of education, Mr. Herbert Wilson of the United States Geological Survey discusses the relation of geography to other sciences.‡ Here we find what we may term the organic conception of geography also expressed. He gently chaffs his fellow-geologists, who have recently become enamoured of the topographic side of their science, for confusing topography and geography, and for believing, as do some historians, meteorologists, and ethnologists, that the science of geography has ceased to exist. He quotes Dr. W. T. Harris's definition, which expresses Prof. Wagner's conceptions, "Geography unites the study of the natural elements, land and water, climate and productions, with the study of man's present conquest and use of the same." He suggests that geography, the oldest of the sciences, bears the same relationship to the natural sciences that civil engineering holds to the allied engineering professions. Prof. Davis has contributed three accounts of his views,§ one of which has appeared in this *Journal*. He would expand the content of geography from the relation of Earth and Man to the relation of Earth and Life; "the cleared roadway of a colony of pillaging ants becomes as properly a subject of geographical study as a railroad that connects centres of human population." This leads to two divisions of geography—the inorganic environment which he terms physiography (which has now three different meanings thrust upon it), and the other, not the organic complexes, but the "responses which life has made to its environment," which he calls ontography. Ontography is more than ecology, for it includes "all the responses of organic forms to their physical environment, whether in physiological structure, in individual behaviour, or in

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* "Triebkräfte und Richtungen der Erdkunde im XIX. Jahrhundert." Von Frhr. v. Richthofen. *Zeits. Gesells. für Erdkunde*. Berlin, 1903. See *Geographical Journal*, February, 1904 (p. 229).

† "La géographie a précisément pour objet de rechercher les relations qui unissent ainsi l'homme à la terre." "Les principes de la géographie moderne." M. Ardaillon. *Bull. Soc. Géog. de Lille*, 1901.

‡ "The Relation of Geography to the Sciences." By H. M. Wilson. *The First Year-Book of the National Soc. for Scientific Study of Education*, Part ii. Chicago, 1902.

§ "Systematic Geography." By W. M. Davis. *Proc. American Phil. Soc.*, vol. xli., No. 170, 1902. "The Progress of Geography in Schools." By W. M. Davis. *The First Year-Book of the National Soc. for Scientific Study of Education*, Part ii. Chicago, 1902. "A Scheme of Geography." By W. M. Davis. *Geographical Journal*, vol. xxii. October, 1903.

racial habits." It is the element of relationship between physiography and ontography which constitutes geography.

Just as the study of ecology has led botanists to a physiological classification of plants, which is of much greater value to the geographer than any morphological one, so we believe the study of biological and anthropological ontography, to use Prof. Davis's term, will help the geographer. The elements of anthropological ontography have been worked out, not merely in Ratzel's well-known books, but in a more inductive way in the writings of Le Play and his followers. Undoubtedly the possession of physiological (or ontographical) classifications of organic phenomena will lead to a new examination of distributions of organic life which will have a most stimulating effect on the geographer, especially if his chief interests are anthropological.

Prof. Davis is, however, not dealing similarly with his two divisions. He defines physiography as the total inorganic environment, but ontography is merely the *responses* in the organic world to the inorganic stimuli. While agreeing that it is highly desirable that such responses should be systematically investigated, and that the results will be of the greatest possible advantage to the geographer, we feel that geography is not completely defined when it is said to be the relationship between physical environment and the organic responses to it.

Prof. Davis seems to be approaching the definition of geography which has been given by Dr. Mill in the 'Encyclopædia Britannica' as "the exact and organized knowledge of the distribution of phenomena on the surface of the Earth." Dr. Mill further says that "the distinctive task of geography as a science is to investigate the control exercised by the crust-forms directly and indirectly upon various mobile distributions." This is a natural development of the definition of Dr. Keltie in 'Chambers's Encyclopædia'—that geography investigates the features of the Earth's surface and the distribution and mutual topographical relations of all which that surface sustains.*

* Prof. Charles R. Dryer, in a suggestive paper on "What is Geography?" (*The Teachers' Journal*, Marion, Indiana), published since the above was written, says, "Geography has passed through a long period of development, and the end is not yet. In the early stage it was a description of the Earth. In the scientific stage which now prevails everywhere outside some schools, it is 'the exact and organized knowledge of the distribution of phenomena on the surface of the Earth.' In the third evolutionary stage, which is just beginning, it is 'the relation between the physical environment and the environed organism, between the Earth and its inhabitants.' This third and perhaps final stage of geography is based, 'not upon the doctrine of the adaptation of the Earth to man, but upon the more evolutionary principle of the adaptation of all the Earth's inhabitants to the Earth,' and the definition of the future may come to read something like this: 'Geography is the science which deals with the distribution of every feature and the environment of every creature on the face of the Earth.'" This states very clearly the ideas outlined by Prof. Davis, and shows that it is the Guyot conception expressed in terms of the control exercised by the environment on life instead of in terms of the providential adaptation of the environment to man's

The study of the distribution of any phenomenon presupposes the recognition and classification of that phenomenon. The individual rock, or plant, or animal is easily recognized; but no serious advance in geography was possible without a recognition of higher groups of organisms. Morphological, specific or generic, groups were not enough. As has proved to be the case in geology and meteorology, so in botany, zoology, and anthropology, the morphological groupings devised by the specialists in these fields of science have not been of the same value to geographers as other classifications based on physiological considerations. The old threefold classification of plants into tree, shrub, and herb was a better division for the geographer than the newer angiosperm and gymnosperm and cryptogam. It is this that Prof. Davis clearly feels in the case of the organic sciences, and he gives expression to his feeling in his definition of ontography.

The physiological grouping of organisms into plant, animal, and human associations is really what is required by the geographer, just as he must have a genetic classification of land forms, and a dynamic one of aërial and oceanic ones. These classifications are essential for geographical progress, and where they do not exist the geographer is diverted from his special work in order to investigate them. The meeting-place of the student of land, or air, or ocean, or plant, or animal, or man, with the geographer is in the examination of the distribution of these groups; but while each other specialist concentrates his attention on the distribution of the phenomena with which he is specially concerned, the geographer deals with the distributions of all. The fundamental facts of geography are these distributions. Starting from them, the geographer studies their relations, and discovers, what I think has not been seen with sufficient clearness in this country at least, that the higher organisms, the plant, animal, and human associations, are incomplete without some connecting framework, and that that framework is the physical configuration. Prof. Ratzel has done most to emphasize the importance of the space relations as the fundamental element in geography. In this country his books are still too little known. In his wonderfully rich and varied works, however, the point of view is almost exclusively that of the geography of man.*

More than this recognition of spacial relations in human geography is necessary, for each of these higher physiological groups is incomplete without the others. The higher organism is not simply the natural plant "association," or even the nation, but the other distributions

needs. It is distinctly less general than Dr. Mill's definition, quoted as illustrative of a prior stage. Any scientific study of distribution must take into account problems of development.

* See especially 'Die Erde u. das Leben.' 2 vols. Leipzig, 1901, 1902. 'Anthropogeographie,' 2 vols., vol. i. in second edition. Stuttgart, 1899, 1891. 'Politische Geographie,' 2nd edit. Leipzig, 1903.

which exist within its confines are essential elements of it. The configuration is the relatively stable framework, the atmosphere and running waters the variable circulations which together determine the complex of organic forms including man, controlled by them all and more or less utilizing them all. Take away any one of these elements, and we are dealing with less than a geographical unity.*

These geographical units we may term natural regions, but we have to recognize that there are different orders of natural regions, from a highland glen to a mountain system. This is not the occasion on which to examine the major natural regions, of which there are some fifteen types. The work immediately ahead for the geographer is the study of type natural regions, of all orders of complexity. The recognition of such natural regions and the knowledge of their characteristics are of the greatest practical importance to all men of affairs. It will afford a guide to action which they at present lack, and save countless expensive and heartrending failures.

This aspect of geographical work must also be dealt with in another article.

Geography applied to Education.

It is not commonly recognized that one of the most important applications of geography is to education. As long as geography was confused with gazetteer knowledge, it was natural that a head master should say, as some still do, that geography should be learned incidentally, or that a university committee should be advised that Bradshaw and Whitaker supplied sufficient geographical information for a student in a faculty of commerce. The persistence of this confusion probably explains the extraordinary omission of a systematic study of the possible theatres of war from the recent programmes for military cadets, whether at military colleges or at the universities.

While nearly every one admits that geography must be taught some time during school years, the problems of what geography is, and what parts of it are suitable for educational purposes, are too seldom discussed. All geography is not suitable for schools. There must be a selection of matter, and, further, an arrangement of it in an educational, not a logical scientific order. The gazetteer contents and the text-book order have both to be rejected. If we look at our present text-books we find several types, of which the comparative, with its ingenious but often superficial and sometimes most misleading comparisons, and the tit-bits, with its brightly written, interesting

* Prof. Vidal de la Blache, one of the chief inspirers of the geographical renaissance in France, has expressed this idea in the preface to his atlas (Paris, Colin): "La géographie a donc devant elle un beau et difficile problème, celui de saisir dans l'ensemble des charactères qui compose la physionomie d'une contrée, l'enchaînement qui les relie, et dans cet enchaînment une expression des lois générales de l'organisme terrestre."

paragraphs of information tacked on to the main statements, are the most popular. Both have done good service in altering geography from a pepper of place-names to a subject which has at least some slight claim to be fit for educational nourishment.

Most text-books and most syllabuses are divided into two parts—a general and a special; a so-called physical and political geography, but at present too often merely a physiography and a more or less gazetteer-like geography arranged according to political subdivisions. In some programmes these two parts are marked as alternatives for examination, and teachers most interested in educational discipline choose the former, while utilitarians select the latter.

The problem of text-book order, however, is quite a different one from that of the teaching order, unless the teacher is to abdicate his functions and become a mere "recitation" master, as the Americans so aptly term it. The order of presentation of geographical facts will vary with the position of the school, the experience of the pupils, and also with the interests of the master. It is important not to be dogmatic about this, but to leave as much freedom as possible to the teacher, once it is clear that he understands the subject.

In one of the last papers written by him, the late Mr. Rooper classified the various methods of dealing with geography in schools. This forms a useful guide to those beginning the study of the problem.* Many books and papers have been produced, more particularly in Germany, reviewing all or suggesting new methods. It is impossible to summarize them in this article. The titles of some are given below.†

In our own country many suggestions have been made, of which the most authoritative are those on drawing up syllabuses in geography prepared by Mr. Chisholm, Mr. Mackinder, and Mr. Rooper, and issued by the Royal Geographical Society.‡ At many of the annual meetings of teachers' associations papers have been read both by teachers interested in geography and by geographers interested in teaching, and have given rise to much discussion. Among them, two addresses by Mr. Mackinder§ have done much to combat the practice of planning

* "Methods of Teaching Geography," T. G. Rooper, *Geographical Teacher*, vol. i. No. 1, October, 1901.

† "Zur Methodik des erdkundlichen Schulunterrichts," H. Fischer, *Zeits. Gesells. Erdk. zu Berlin*, No. 2, February, 1902; "Geographical Text-books and Geographical Teaching," M. K. Genthe, *Journal of Geog.*, vol. ii., 1903; "Ziel und Methode des geographischen Unterrichts," Langenbeck, *Geog. Zeits.*, vol. ix. No. 2, February, 1903; "Geography in Germany," J. R. Smith, *Journal of Geog.*, vol. i. Nos. 9 and 10, November and December, 1902; "Geographischer Anzeiger" (Gotha), *passim*; various syllabuses which have appeared in the *Journal of School Geog.* and its successor the *Journal of Geog.*; and most fully in Dr. C. Gruber's "Geographie als Bildungsfach," Leipzig, 1904.

‡ 'Syllabuses of Instruction in Geography.' R.G.S., 1, Savile Row, W. 1903.

§ "Geography in Education," *Geog. Teacher*, vol. ii. part 3, October, 1903; "From Nature Study to Geography," *Ibid.*, vol. ii. part 5, June, 1904.

separate courses in physical and political geography. In one he emphasizes the importance of the regional conception, and this has formed the theme of several papers mainly by his pupils.* In the other he traces a method of gradually specializing the geographical teaching from that of home lore or nature study.

Another set of recent papers deals with practical work in geography and its educational value. It is not necessary to discuss this question in detail, as a special committee of the British Association is preparing a report on the subject, but the titles of a few papers may be given.†

What impresses one in the majority of these papers dealing with geography in schools is that the course is planned as if geography was a subject quite unrelated to others, and to be taught independently of them. This gives some validity to the argument of the ordinary head master who says the school time-table is already too full and complicated for him to think of altering it by further recognition of geography. Schoolmasters, however, will have to face the problem of replanning their time-tables, not in order to include the maximum number of separate subjects, but to permit the maximum co-ordination and the least possible separation into isolated subjects. It will be necessary for them to pay much more attention to classifications of knowledge than they have hitherto done. A rational system of intellectual education must be based on a sound classification of the sciences grouped according to the different educational disciplines they afford. The mere twisting of a kaleidoscope containing the fragments of knowledge traditionally taught will not suffice. Attempts to make this do have resulted in highly complex time-tables, which reflect the accidental if occasionally pretty juxtaposition of diverse unrelated elements.

The conception of geography we are now advocating makes it one of the desired subjects which transmutes the diverse and apparently unrelated elements into a naturally constituted complex. It permits a reconciliation between the views of the utilitarian and the educationalist, between the student of physical science and the humanist. Geography, as we have seen, is not physiography plus topography. Its method is not primarily analytic, but synthetic, and hence it did not progress rapidly in times of intense analytical specialism. We are entering on

* "Regional Geography," J. A. White, *Geographical Teacher*, vol. ii., February, 1904; "Regional Geography," J. B. Reynolds, *Geographical Teacher*, vol. ii., February, 1904; "Regional Geography in the Schools," J. F. Unstead, *Geographical Teacher*, vol. ii., October, 1904.

† "Field Work in Physical Geography," W. M. Davis, *Journal of Geog.*, vol. i., 1902; "Practical Exercises in Physiography," W. M. Davis, *Journal of Geog.*, vol. ii., 1903; "The Scope and Practical Teaching of Geography in Schools," A. Morgan, *Geographical Teacher*, vol. ii., June, 1903; "Excursions and the Teaching of Geography," J. Lomas, *Geographical Teacher*, February, 1904; "Practical Use of the Globe," T. Alford Smith, *Geographical Teacher*, vol. ii., June, 1904; "The Use of Large-Scale Maps," A. J. Herbertson, *Geographical Teacher*, vol. ii., October, 1904.

another time, and, as de Lapparent has said, the day of wider syntheses is dawning. The geographical synthesis is one of the most important, involving as it does the space relationships of groups of phenomena on the Earth's surface. Its educational value lies in its being a synthesis which in its simpler elements is obvious to the very young, and in its more complex ones presents problems difficult enough to attract the keenest intellects, while its results have a direct bearing on national as well as on individual life. Instead of being most suitable and important in the junior classes, the reverse is nearer the truth.

No subject but geography, unless it be sociology, gives the comprehensive outlook on *existing* conditions which must be taken into account in all the larger problems of life, and hence it cannot be ignored with impunity, even in the upper classes of a classical school.

Even in some parts of Germany this is not yet recognized, and the latest congress of German geographers found it necessary to protest against the official point of view.* This is, that "geography is but a technical subject valuable only for its practical utility, but otherwise of no educational interest." Dr. Lampe told the congress of a school inspector from Berlin, a privy councillor, who interrupted a head master when discussing in the geography class the climate of India and its effects on harvests and famines, reprimanded him for wandering so far from the subject, and forthwith began to question the class himself on the capes, mountains, and rivers of Asia! We do not wonder, then, that in Prussia descriptive geography is a subject in the lower classes of gymnasia, and scientific geography is banished from such schools altogether. Even an enlightened director such as Dr. Cauer, of Düsseldorf,† who will find many sympathizers among our public schoolmasters, maintains that no special geography teaching is possible in the upper classes of gymnasia save as an appanage of history. He insists that "classical" history is the subject round which the work of a gymnasium must be planned, but he suggests that for Real-gymnasien and Realschulen geography might well be made the central subject.

Admitting that the evolution of human endeavour and thought in the Mediterranean basin in Greek and Roman times is the best subject to emphasize in schools for the "upper classes," and assuming that this inspires the work of our public schools, geography is, perhaps, nowhere more indispensable both to correlate and to correct—to correlate, by presenting as it does the most stable elements which have permanently influenced the successive phases of Mediterranean history, and set the limits as well as presented the opportunities for human

* "Verhandlungen des vierzehnten deutschen Geographentages zu Cöln," am 2, 3 und 4 Juni 1903 (Berlin: Reimer, 1903), pp. 161–192. Discussion, pp. xxiv.–xxxii.

† "Ueber die Stellung des Geographischen Unterrichts am Gymnasium," P. Cauer, *Geographische Zeitschrift*, viii., 1902, p. 465. See also discussion at Cöln meeting of German geographers noted above.

endeavour within the Mediterranean area; to correct, by forcing the attention to the existence of other civilizations under other conditions, and so preventing the popular delusion that there has been only one area with a highly developed civilization. As a corrective it is specially necessary in classical education, as it forces the attention on the complexity of modern conditions outside the Mediterranean basin, which renders any direct application of conclusions justified for this area in ancient times inadvisable without some attempt to estimate the disturbing effect of different circumstances, geographical in the first place, historical in the second. The geography taught, however, must be something very different from much that is commonly called by that name, and in classical schools the human aspects would be emphasized, and the subject would not be so precisely limited as in a purely geographical treatise.

The recognition of this is a matter of national moment; for in addition to its educational value, geography is of immediate practical importance to pupils in the higher classes of public schools, who will direct the higher administration of public and private affairs. The geographical factor is of supreme significance in administrating a colony, in planning a campaign, or in controlling a large business. Surely it is only common sense to see that it is properly studied by those who will have to direct great enterprises. When its educational and practical value are both taken into account, only ignorance or inertia or the influence of vested interests can explain its omission from the higher classes of schools or from the university.

NOTES ON THE ANGLO-LIBERIAN FRONTIER.*

By Lieut. E. W. COX, R.E.

The Anglo-Liberian Boundary Commission spent the first six months of 1903 in delimiting and beaconing this frontier. Their work started at the source of the river Niger, lat. 9° 5′ N., long. 10° 47′ W., and ended at the mouth of the river Mannah. The boundary itself started from the intersection of the river Uldafu with the 13th meridian west of Paris, and followed this meridian south to its intersection with the left bank of the river Mannah at low water, which then became the boundary to the coast.

Triangulation was adopted from the Niger source to the starting-point of the boundary. A subtense traverse was carried down the meridian to the river Mannah, and a chain and compass traverse from the Mannah river beacon to the coast.

The subtense traverse gave good results, the average discrepancy between the two values of a ray being 1 in 400. The error of the chain and compass traverse was 1 in 55. The course of the river Meli,

* Map, p. 504.

which was shown inaccurately on existing maps, was traced from lat. 9° 5′ N. to within a mile or two of its junction with the river Moa.

The outpost towns of Kamiendo and Kanre Lahun, about which opinions had varied very widely, were found to be 5 and 2 miles in Liberia respectively. But the outpost town of Korumba was placed some 4 miles west of the boundary.

The Kissi tribe, whose raids along the frontier were still a constant source of trouble for about 30 miles north of the river Moa, did not molest the Commission in any way, probably on account of the large escort of fifty-five men of the West African Frontier Force. The positions of some of the Kissi strongholds in Liberia were fixed by intersection.

The town of Kenewa, which was the farthest point that the Government railway survey had reached at that time, was found to be just west of the boundary. Vahan, an ancient rebel stronghold some 8 miles in Liberia, which had been destroyed in 1898, was visited by part of the Commission. The chief, Bagba, was found to be making every effort to rebuild his town, and restore it to its former importance.

The forest which stretches south from Bariwalla had been described as impenetrable, and inhabited only by elephants and rubber. A road was cut through this forest approximately following the meridian, and traces of elephants and rubber were met with. The course of the Morro river, previously unknown, was traced between Goli and the boundary, and that of the river Mannah from the boundary eastward to the Gola town of Jui in Liberia. The Gola town of Gelaun, some 6 miles north of Jui, was also fixed from Bariwalla. The river Mannah at the boundary is called Mano, or Bewa, and it is only near the mouth that it is called Mannah. All doubts as to whether the Mano or Morro river was the larger were settled by a measurement of the volume of each at their junction. The Mano was found to be the larger. Both the Morro and Mano rivers were in flood when the Commission crossed them. At the boundary they were 40 yards and 100 yards wide respectively, and at their junction 100 yards and 120 yards. The course of the river Mano from its junction with the Morro was traced almost continuously to the coast. It was found to be navigable up to a few miles north of the town of Dia (on its right bank), which is 21 miles from the mouth. On leaving the meridian at its intersection with the river Mano, the Commission at first marched in Liberia, following the road from Jui through Gola Gene to the point where this road crosses the river Mano, opposite the large town of Ba, which lies about $1\frac{1}{2}$ mile from the right bank. At this point the Commission crossed the river and followed the road through Dia to the coast. The natives in Liberia along the Jui—Gola Gene road were in a state of unrest owing to the raids of a marauding chief, Barome. No attempt up to that time had been made to suppress him. As a result of the Commission's work, the mouth of the river Mannah was placed 2 miles westward of its

previously accepted position. The country along the boundary seemed to be rich and fertile, especially in the Meli and Moa valleys, but of course the natives were growing only enough rice, cotton, etc., for their own use. No signs of minerals were met with. Owing to the shortness of the working season, however, the Commission had no time to make any thorough researches in this direction. A word must be said in praise of the Mendi carriers who accompanied the Commission for the whole of the six months. Their work was always hard, owing to the large amount of clearing that had to be done. At one time they were reduced to very short rations, but they gave no trouble, and were always cheerful.

LOCH NESS.*

I. THE BATHYMETRICAL SURVEY OF LOCH NESS.

By T. N. JOHNSTON, M.B., C.M., F.R.S.E.

Loch Ness, which is one of the most beautiful lochs in Scotland, is the largest of the series lying in the great glen of Scotland, and forming the greater part of the waterway known as the Caledonian Canal. It trends in a south-west to north-east direction, extending to a length of 22½ miles, with a maximum breadth, at Urquhart bay, of over 1¾ miles, and covering an area of 21½ square miles. The mean breadth is almost one mile. From a bathymetrical point of view, Loch Ness is an important loch. For a long time it has borne the reputation of being very deep, and this the soundings of the Lake Survey substantiate. The members of the Lake Survey visited Loch Ness in April, 1903, and took soundings, temperature observations, and tow-nettings. During the summer Sir John Murray and members of the staff stayed at Fort Augustus, at the south end of the loch, and carried on continuous observations on the temperatures, seiches, biology, etc. These observations have been continued during the winter by Mr. E. R. Watson, B.A., and Mr. James Murray. In June, 1903, a "limnograph" (an instrument for recording "seiches," which are oscillations of the whole mass of water in a lake) was erected at the monastery pier at Fort Augustus, under the care of Mr. E. M. Wedderburn, M.A., and some good records have been obtained. More recently a series of electrical resistance thermometers has been installed under the care of Mr. E. R. Watson.

Previous to 1903 no systematic soundings had been made in Loch Ness, with the exception of those taken early in last century at the time of the making of the Caledonian Canal, when a series of soundings was taken along the centre of the loch, and a maximum depth of 774 feet (129 fath.) obtained. The Lake Survey did not find so great a depth, the maximum obtained being 751 feet (125 fath.), at a spot almost in the centre of the loch 1¼ miles to the south of Urquhart bay. On the old chart supplied by the canal authorities, the soundings in the shallower portions of the loch practically agree with those taken by the Lake Survey, but in the deeper water the depths differ by 5 or 6 fath., and in some cases the differences are greater. Similar differences have occurred in other lochs which have been sounded by means of rope lines. Loch Morar, which lies in the south-west of Inverness-shire, and which in all probability is the

* Meeting of Research Department, January 18, 1904.

deepest loch in the United Kingdom, was stated to have a depth of 1030 feet, but the greatest depth obtained by the Lake Survey during many hours' search over the limited 1000-feet area was 1017 feet.

In Loch Ness the Lake Survey took about 1400 soundings, using the Pullar sounding-machine, and these soundings are all reduced to the datum level of 52·6 feet above sea-level, which was the level of the water surface on the first day that operations were begun.

The loch is fed by numerous burns and several large streams. The rivers Oich and Tarff fall in at the head of the loch at Fort Augustus; on the west side the Moriston, the Coilte and the Enerick enter, and on the east side the Foyers and the Farigaig. The river Ness, issuing from the north end, drains the loch. The drainage area of Loch Ness is very extensive; it extends to 696 square miles, being more than 32 times the area of the loch.

The basin of Loch Ness is of a simple character, and probably at one time the 600 and 700 feet areas were continuous from end to end, but the detrital material brought down by the river Foyers has filled up the bed of the loch to a considerable extent, dividing the areas over 600 and 700 feet deep into two divisions. The bottom of Loch Ness is remarkably level, showing no irregularities, with the above exception, and it is covered with black peaty mud, and in places with a stiff clay of a dull yellow colour. The absence of islands is striking, there being only one small islet, called "Cherry island," near the west shore not far from Fort Augustus. It is said that the level of Loch Ness was raised a few feet when the canal was made, but at one time the water must have stood at a considerable height above its present level, as is shown by the terraces at the mouth of the river Foyers, and by the beaches which can be seen at Dores, at the north end of the loch.

The slopes of the sides of the basin are very steep, especially on the west side to the south of Abriachan, and on the east side, where off the "Horseshoe" a depth of 316 feet was obtained at a distance of 150 feet from shore; on the same side, opposite Invermoriston, soundings of 652 feet were obtained at a distance of 360 feet from shore. The mean depth of Loch Ness is very great, being 436 feet. Loch Morar, which has a maximum depth of 1017 feet—266 feet more than Loch Ness—has a mean depth of 284 feet. The volume of Loch Ness is estimated at 261,000 million cubic feet, which is about three times that of Loch Morar, so that Loch Ness may fairly be regarded as the largest body of fresh water in Great Britain.

II. MOVEMENTS OF THE WATERS OF LOCH NESS, AS INDICATED BY TEMPERATURE OBSERVATIONS.

By E. R. WATSON, B.A., B.Sc.

The view that the waters of the Scottish lochs were at rest, and that the temperature changes were due to the transmission of heat through the stagnant waters, was long ago rendered untenable. In a paper * published in the year 1888, Sir John Murray showed that the distribution of temperature in the waters of Loch Ness was very largely dependent on the force and direction of the winds blowing over the surface of the loch. In connection with the Survey of the Scottish Lochs, which is being carried on under the superintendence of Sir John Murray and Mr. Laurence Pullar, it was considered desirable to undertake a detailed study of the temperature conditions of the waters of Loch Ness.

* Murray, "On the Effects of Winds on the Distribution of Temperature in the Sea and Fresh-water Lochs of the West of Scotland," *Scott. Geogr. Mag.*, vol. iv. p. 345, 1888.

Accordingly, I, together with Sir John Murray, Mr. E. M. Wedderburn, and other members of the Lake Survey Staff, commenced in July, 1903, a systematic study of the temperatures of the different strata of water in Loch Ness. As a first step, the temperatures were taken at the station near Fort Augustus several times a day for several days. Temperature-depth curves were drawn from these observations and examined. Fig. 1 gives a few of these curves. Had the waters of the loch been at rest, there would have been observed considerable regularity in the temperature changes—a steady seasonal rise of temperature compounded with a slight diurnal fluctuation in the upper strata, and the magnitude of the temperature changes always smaller for the deeper strata than for the upper strata. There was observed no such regularity in the temperature changes, as will be seen by a glance at Fig. 1. On a first examination, it

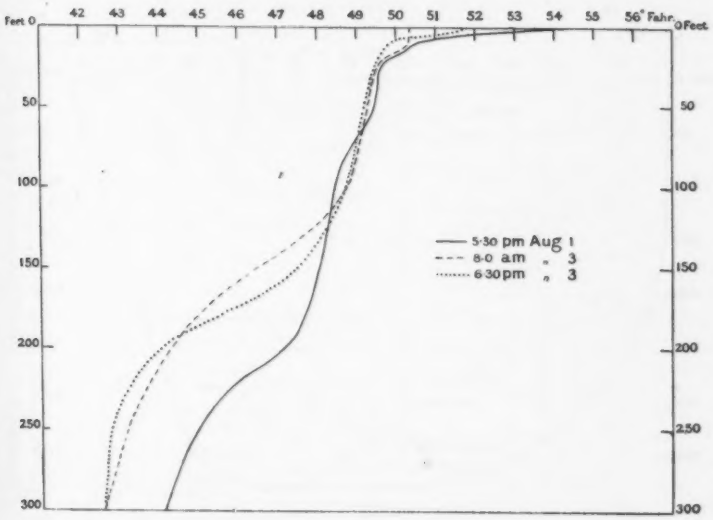

Fig 1

seemed that the temperature at any depth down to 300 feet was liable to large and sudden changes, by which it was either increased or decreased, and there seemed to be no relation or co-ordination between the temperature changes at different depths. The only conclusion which could be drawn from such observations was that the waters of the lake were continually moving—that there were considerable currents throughout the whole volume of water from the surface right down to 300 feet at least, and that the temperature changes were due to these currents, which were continually replacing the water at any one point by water at some other temperature.

The observations were now extended. Cruises were made along the loch in a steam-launch, and temperature series taken at four or five stations equally spaced along the axis. It was found that these large and irregular temperature changes were not confined to the station near Fort Augustus, but that changes equally large and irregular occurred at all the stations. But, at the same time, the temperatures at any one of the stations differed from those at the other stations.

In order to study the observations made during cruises, a vertical longitudinal section through the loch basin was made, and vertical lines drawn at the observation stations. The temperature observations made were recorded at the proper distances below the surface along these lines, and isothermal lines were drawn connecting the points having a common temperature. For convenience, the isotherms 53°, 51°, 49°, 47° Fahr., etc., were drawn. Such a section is shown in Fig. 2.

It may here be mentioned that Loch Ness is a long, narrow, straight basin, and that consequently it is possible, by means of this one vertical longitudinal section, to give an almost perfect representation of the distribution of heat throughout the loch.

By an examination of a series of such diagrams, it was found that—

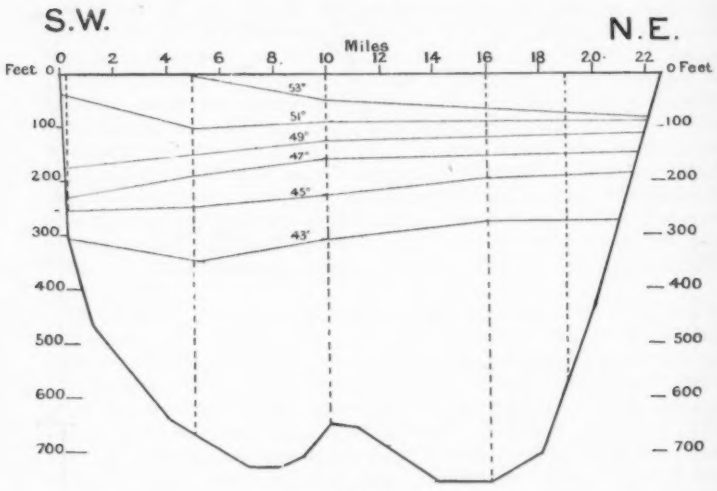

Fig. 2

(1) *The isotherms are never horizontal, but are inclined at all possible angles, some being, as a rule, sloping in the opposite direction from others.*

(2) *The isotherms are continually and quickly altering their inclinations:* the changes are so great and rapid that the diagram drawn as the result of one day's cruise would be found entirely different from that given by the preceding day's cruise.

(3) The area between two consecutive isotherms remained practically constant from one day to the next, although of course the shape of this area had entirely altered.

This last result was of the greatest use for a study of the currents: it meant that the bulk of water at any particular temperature remained practically constant, although this water was being continually moved to and fro by currents, and that if it had been possible to replace the isothermal surfaces by watertight but perfectly flexible membranes, then these membranes would not have affected the changes occurring in the loch. But it is obvious that by watching the movements of such membranes we could have gained a great insight into the current system of

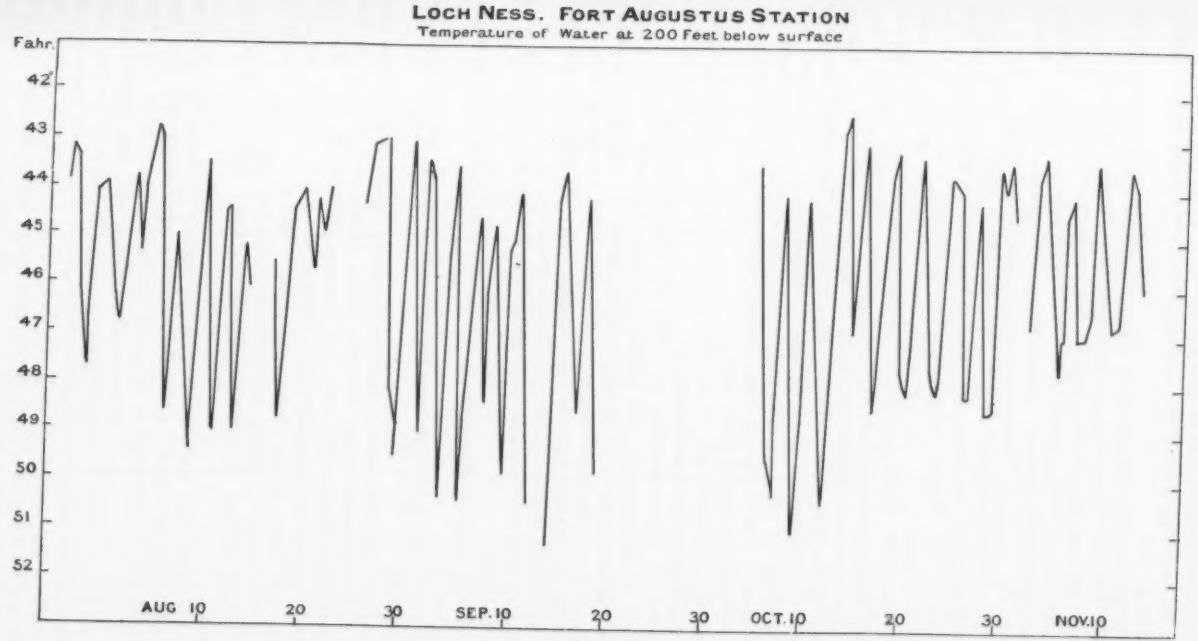
LOCH NESS. FORT AUGUSTUS STATION
Temperature of Water at 200 Feet below surface
Fahr.
42
43
44
45
46
47
48
49
50
51
52
AUG 10
20
30
SEP. 10
20
30
OCT. 10
20
30
NOV. 10

Fig. 3

the loch—hence the utility of a study of the motion of the isotherms, for they are nothing but these hypothetical watertight partitions made visible by temperature observations.

An attempt was now made to study the cause and method of these movements of the isotherms—in other words, the current-system of the loch was examined.

It has long been held by oceanographers that a wind blowing along the surface of the ocean will produce a surface-current in the same direction as itself, and such a surface-current will necessarily produce consequent-currents. Sir John Murray has shown the existence of similar currents in several Scottish lochs.

By the use of these suggestions it was found possible to make a short statement describing briefly, but accurately, the cause and mode of movement of the upper isotherms. A wind blowing along the surface of the loch blows with it the hot surface-water, which is thus gathered to the lee end of the basin, whilst colder water comes to the surface at the windward end to take its place. In terms of isotherms, a wind blowing along the surface of the loch produces, or tends to produce, a slope of the upper isotherms down towards the lee end of the loch. I say "tends to produce," because the observations on Loch Ness show that a south-west wind produces this effect much more easily than a north-east wind. There seems to be a predisposition on the part of the upper isotherms to slope down towards the north-east end of the loch. This may be due to the head-to-foot flow of the loch, which is from south-west to north-east.

But whilst the movements of the upper isotherms are thus easily summarized, those of the lower isotherms remained for a considerable time a complete mystery. It was natural to suppose that the deeper the isotherm the less would it be influenced by the winds, and that perhaps a strong wind would produce a slight tilt in the deeper isotherms in the same direction as the tilt in the upper isotherms, but that, as a rule, the deeper waters would remain uninfluenced and at rest, and that the deeper isotherms would be horizontal surfaces. This, however, was found to be by no means the state of affairs. It was found that—

(*a*) Very often the lower isotherms had a tilt in the opposite direction from the upper isotherms;

(*b*) There was no more approach to horizontality in the lower isotherms than in the upper;

(*c*) Even after a protracted calm the isotherms were still not horizontal, and still in motion.

To study these movements of the lower isotherms, I made use of the systematic temperature observations which have been taken several times a day at the Fort Augustus station, begun July, 1903, and continued right on till the waters had become of almost uniform temperature throughout. I drew curves giving the change with time of the temperature at different depths. Fig. 3 gives the change with time of the temperature at 200 feet below the surface.

The table on page 435 gives the observations from which Fig. 3 was constructed.

It will be seen that the temperature at this depth at the Fort Augustus station changed in a regular periodic fashion, the length of a period being about three days, and the difference of temperature between a maximum and a minimum being about 5° Fahr. By drawing similar curves for other depths, I found that at greater depths the temperature exhibited the same periodic change, the length of the period being the same and the phase the same, whilst the amplitude got less and less the greater the depth of the point considered. Similarly, at less depths than 200 feet the change had the same periodicity and the same phase, and again smaller amplitude than at 200 feet, but here the regular nature of the change was somewhat obscured,

apparently by other changes occurring at the same time—those changes due to the wind which we have already mentioned.

LOCH NESS, FORT AUGUSTUS STATION. TEMPERATURE OF WATER AT 200 FEET BELOW SURFACE.

Time.	Temp. (corr.) Fahr.	Time.	Temp. (corr.) Fahr.	Time.	Temp. (Corr.) Fahr.
	°		°		°
July 27, 7.45 a.m.	43·9	Sept. 1, 8.0 a.m.	49·1	Oct. 20, 4.30 p.m.	48·2
„ 27, 5.0 p.m.	43 2	„ 1, 7.0 p.m.	43·4	„ 21, 10.30 a m.	47·1
„ 28, 8·0 a.m.	43·4	„ 2, 8.0 a.m.	43·8	„ 22, 10.0 a.m.	43·3
„ 28, 9.0 p.m.	46·3	„ 3, 8.0 a.m.	50·3	„ 22, 4.0 p.m.	43·3
„ 29, 8.0 a.m.	47·8	„ 3, 6.0 p.m.	47·4	„ 23, 10.0 a.m.	47 8
„ 29, 12.0 noon	46·7	„ 4, 8.0 a.m.	45·1	„ 23, 6.0 p.m.	48·2
„ 30, 12.0 noon	44·1	„ 4, 7.0 p.m.	43·5	„ 24, 10.30 a.m.	47·5
„ 31, 8.0 a.m.	43·9	„ 5, 8.0 a.m.	50·4	„ 24, 4.30 p.m.	47·4
„ 31, 9.0 p.m.	45·1	„ 5, 6.0 p.m.	48·0	„ 25, 10.30 a.m.	43·7
Aug. 1, 8.0 a.m.	46·4	„ 7, 8.0 a.m.	44·6	„ 26, 10.0 a.m.	44·0
„ 1, 6.0 p.m.	46·8	„ 7, 5.0 p.m.	48·4	„ 26, 4.0 p.m.	48·2
„ 3, 8.0 a.m.	43·8	„ 8, 8.0 a.m.	46·2	„ 27, 10.0 a.m.	48·2
„ 3, 7.0 p.m.	45 3	„ 8, 6.0 p.m.	44·7	„ 27, 8.0 p.m.	46·0
„ 4, 9.30 a.m.	44·0	„ 9, 8.0 a.m	46·6	„ 28, 8.0 a.m.	44·6
„ 5, 8.0 a.m.	42·8	„ 9, 7.0 p.m.	49·9	„ 28, 10.0 a.m.	44·2
„ 5, 9.0 p.m.	43·0	„ 10, 8.0 a.m.	45·3	„ 28, 8.0 p.m.	48·5
„ 6, 8.0 a.m.	48·6	„ 10, 7.0 p m.	45·0	„ 29, 8.0 a.m.	48·4
„ 6, 6.0 p.m.	46·7	„ 11, 8.0 a.m.	44·1	„ 29, 8.0 p.m.	48·6
„ 7, 7.0 a.m.	45 0	„ 12, 8.0 a.m	50·4	„ 30, 8.0 a.m.	43·5
„ 8, 12.0 noon	48·0	„ 14, 8.0 a.m.	51·4	„ 30, 8.0 p.m.	44·1
„ 8, 9.0 p.m.	49·4	„ 15, 8.0 a.m.	44·2	„ 31, 8.0 a.m.	43·4
„ 10, 12.30 p.m.	43·5	„ 15, 6.0 p.m.	43 6	„ 31, 4.0 p.m.	44·6
„ 11, 8.0 a.m.	49·0	„ 16, 8.0 a.m.	45·0	Nov. 2, 10.30 a.m.	46·8
„ 12, 8.0 a.m.	44·5	„ 17, 8.0 a.m.	48·6	„ 2, 5.0 p.m.	46·0
„ 13, 8.0 a.m.	49·1	„ 18, 8.0 a.m.	44·2	„ 3, 10.0 a.m.	43·7
„ 13, 12.0 noon	47·3	„ 19, 8.0 a.m.	49·8	„ 3, 5.0 p.m.	43·3
„ 14, 8.0 a.m.	45·2	Oct. 5, 5.0 p.m.	43·5	„ 4, 10.0 a.m.	45·7
„ 14, 8.0 p.m.	46·0	„ 6, 9.0 a.m.	47·5	„ 4, 5.0 p.m.	46·0
„ 17, 10.0 a.m.	45·5	„ 6, 5.0 p.m.	49·5	„ 5, 10.30 a.m.	47·7
„ 17, 7.0 p.m.	48·7	„ 7, 9.0 a.m.	50·2	„ 5, 3.0 p.m.	47·1
„ 18, 10.0 a.m.	47·6	„ 7, 4.0 p.m.	48·4	„ 5, 9.0 p.m.	47·1
„ 18, 8.0 p.m.	46·8	„ 8, 9.0 a.m.	44·1	„ 6, 9.30 a.m.	44·5
„ 19, 9.0 a.m.	44·5	„ 9, 9.0 a.m.	51·0	„ 6, 9.30 p.m.	44·1
„ 19, 7.0 p.m.	44·2	„ 10, 10.30 a.m.	48·4	„ 7, 10.0 a.m.	47·0
„ 20, 8.0 a.m.	44·0	„ 10, 1.0 p.m.	44·2	„ 8, 10.30 a.m.	47·0
„ 20, 4.0 p.m.	44·1	„ 12, 9.0 a.m.	50·1	„ 8, 6.0 p.m.	46·5
„ 21, 8.0 a.m.	45·7	„ 12, 2.30 p.m.	50·4	„ 9, 10.0 a.m.	45·0
„ 21, 6.0 p.m.	44·2	„ 13, 9.0 a m.	46·6	„ 9, 9.0 p.m.	43·4
„ 22, 8.0 a.m.	44·9	„ 13, 4.30 p.m.	44·4	„ 10, 10.0 a.m.	46·3
„ 22, 7.0 p.m.	43·9	„ 14, 9.0 a.m.	42·7	„ 10, 9.0 p m.	46·3
„ 26, 8.0 a.m.	44·2	„ 14, 4.30 p m.	42·3	„ 11, 9.30 a.m.	46·8
„ 26, 6.0 p.m.	43·3	„ 15, 10.0 a.m.	46·9	„ 11, 9.0 p.m.	46·7
„ 27, 8.0 a.m.	43·1	„ 15, 3.30 p m.	46·5	„ 12, 1.0 p.m.	45·3
„ 28, 8.0 a.m.	43 0	„ 16, 5.0 p.m.	43·0	„ 12, 10.0 p.m.	43·4
„ 28, 6.0 p.m.	43·0	„ 17, 8.30 a.m.	48·5	„ 13, 3.0 p.m.	43·8
„ 29, 8.0 a.m.	48 0	„ 19, 10.0 a.m.	43·5	„ 13, 9.0 p.m.	46·0
„ 29, 6.0 p.m.	49·2	„ 19, 4.0 p.m.	43·2		
„ 31, 8.0 a.m.	43·0	„ 20, 10.0 a.m.	47·7		

In terms of isotherms, these observations revealed a pendulous swinging of the ends of the isotherms, the amplitude of the swing being greatest for the isotherm in the region 200 feet below the surface, and dying off both above and below this

region. A few other observations taken simultaneously with these at other parts of the loch show that the isotherms are swinging as a whole about a transverse central axis.

To what can this swinging be due?

If we take a long rectangular trough with glass sides, and put into it a layer of water, and above the water a layer of lighter oil, and then disturb the arrangement, one of the movements observed will be a swinging of the interface between the oil and water. The longer the trough the slower will be the period of this movement; a large difference of density between the upper and lower liquids will give a quick period, and a small difference of density a slow period. The time of swing can be calculated from the formula—

$$t = \frac{2l}{\sqrt{g(\rho - \rho')\left(\frac{\rho}{h} + \frac{\rho'}{h'}\right)}}$$

where t = time of swing,
l = length of trough,
ρ' = density of upper layer,
ρ = density of lower layer,
h' = depth of upper layer,
h = depth of lower layer,
g = acceleration due to gravity.

Now, in the loch we have warmer, and therefore lighter, water lying above colder and heavier water, and, roughly speaking, the greatest temperature change occurs about 200 feet below the surface. So it seems to me that, after a suitable displacement, the waters may swing with a movement similar to that observed in the trough, the warmer upper waters taking the place of the oil, and the isotherm in the region of most abrupt temperature change, *i.e.* at about 200 feet, taking the place of the interface between the oil and water. Such a swinging would produce the observed periodicity in the temperatures, would account for the observed fact that sometimes the lower isotherms are tilted in a direction opposite from that of the upper isotherms, and for the fact that even after a protracted calm the isotherms are still in motion. To calculate exactly the period of such a swinging would be a very difficult matter, but we can obtain an approximate value by assuming that the waters above 200 feet are of a uniform temperature equal to the mean, and similarly for the waters below 200 feet.

Thus in August we should have—

ρ' = density of water at 50°·5 Fahr. = 0·999704
ρ = density of water at 43° Fahr. = 0·999965

also we have—

h' = 200 feet
h = 400 feet
l = 131,000 feet

From which we calculate—

t = 68 hours

which is of the same order as the period observed.

Since winds produce a tilt in the isotherms, and the stronger the wind the greater the depth to which its effect is felt, it seems probable that these swingings are started by strong winds which are able to displace the isotherms in the critical region.

It is very important that the observations which have been begun in Loch Ness should be continued and amplified, in order that we may learn more about this extraordinary phenomenon. Up to the present we have only routine observations at one station, taken at intervals of several hours.

During the next season it will be possible to use the electrical thermometers which have now been satisfactorily installed at Fort Augustus, and thus to obtain a continuous record of the temperature change at a suitable depth at the Fort Augustus station. Besides this record, it is very important that we should have simultaneous observations at other stations, say at the centre of the loch and at the north-east end, in order that the movements of the isotherms throughout their whole length may be studied. These observations should extend over a considerable period.

It seems probable that similar movements will exist in other lochs, and it would be exceedingly interesting to determine the periods of such movements in basins of different dimensions, but for the present it would be preferable to study the phenomenon more thoroughly in Loch Ness. I may mention, however, that Prof. Forel believes that certain observations which he has made in Lake Geneva may perhaps be explained by the existence of similar movements in this lake, and that he intends during the forthcoming season to look further into the matter.

III. ON THE IONIZATION OF AIR IN VESSELS IMMERSED IN DEEP WATER.

By E. R. WATSON, B.A., B.Sc.

During the year 1903 and the early part of 1904, in connection with the Bathymetrical Survey of the Fresh-water Lochs of Scotland, I was able to make a few experiments on the electrical conductivity of air enclosed in vessels immersed in the waters of Loch Ness.

Briefly, the experiments may be described as follows:—

Within a cylindrical copper vessel was a small brass cylinder carried by a non-conducting support. This insulated cylinder could be given an electrical charge, and the rate at which this charge leaked away could be examined by reading from time to time the deflection of a gold-leaf attached to the charged cylinder. Since the supports were non-conducting, the leak of the electrical charge was through the air contained in the vessel, and in this way the electrical conductivity of the air in the vessel was examined. The object of the experiments was to compare the rate of leak when the vessel was immersed to various depths in the water of the loch with the rate of leak when the vessel was standing in air. This work was suggested to me by Mr. C. T. R. Wilson, Fellow of Sidney-Sussex College, Cambridge, and is seen to be of great interest when one considers the theories brought forward to explain the leak of electrically-charged bodies surrounded by air. This leak is supposed to be due to the continuous production in the air of a small number of ions, or electrically-charged particles of molecular dimensions. Now, such ions are produced in quantity on the passage of various rays through air, and it is generally supposed that the ionization of ordinary air is due to the passage through it of a radiation of some kind. If this be the case, then it will probably be possible, by surrounding a vessel with suitable matter, to shield it from the radiation, and thus prevent the ionization of the air within it and destroy its electrical conductivity. Mr. Wilson (*Proc. Roy. Soc.*, vol. 68, pp. 159–161) was unable to detect any diminution in the ionisation of the air in a vessel when it

was taken into a tunnel and thus screened by the rocky walls of the tunnel. McLennan and Burton ('Univ. of Toronto Studies,' Phys. Sci. Series, 1903), on the other hand, record a 37 per cent. diminution in the conductivity of air in a vessel by merely surrounding it with a layer of water 25 cms. thick. It therefore seemed of interest to repeat the experiments under conditions which would allow of the vessel being surrounded on all sides by at least 120 feet of water.

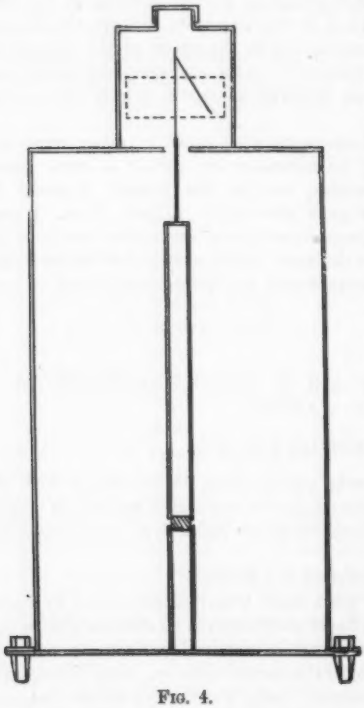

Fig. 4.

Apparatus.—The vessel is shown in section in Fig. 4. It is a copper cylinder of 12 cms. diameter and 20 cms. high, with walls 1 mm. thick. The contained conductor is a brass rod 12 cms. long and 1 cm. diameter, coaxial with the vessel. This is carried by a similar brass rod, 5 cms. in length, rising from the bottom of the vessel, and the two are connected by a short length of quartz rod. The insulated conductor has at its upper end a slight brass rod carrying a gold-leaf. This brass rod projects through a hole 1 cm. in diameter in the top of the cylindrical vessel, and is surrounded by a small copper cube, sides 5 cms. long, containing windows through which the gold-leaf can be read by means of a telescope. At the top of the cube there is a small brass cap, which can be removed to charge the conductor.

The air within the vessel is kept moderately dry by means of calcium chloride carried in a gauze-covered tray fastened to the bottom of the vessel.

This vessel can be rigidly fixed within a cast-iron shell with walls 0·5 cm. thick. This outer shell can be closed watertight and lowered by means of a line to any required depth in the water.

Preliminary Observations.—By observing the rate of leak when the vessel was standing in air, the following facts were learnt:—

(1) The deflection of the gold-leaf, over a considerable range, was proportional to the potential of the charge on the conductor. This made it possible to express the rate of leak completely by saying that in unit time the displacement of the gold-leaf decreased by so many divisions.

(2) The rate of leak varied somewhat from day to day. There was an apparently irregular variation of 5–10 per cent.

(3) The rate of leak was not altered by surrounding the vessel with the cast-iron shell.

By enclosing the vessel in a bell-jar and reducing the air-pressure, it was found that for moderately low pressures the rate of leak was proportional to the air-pressure. The following table gives the experimental results:—

Pressure (cms. of mercury).	Rate of leak.
18·6	0·67
11·4	0·42
5·15	0·21
2·85	0·11

By plotting a curve (Fig. 5), giving the pressure and the rate of leak as respective co-ordinates, it is seen that the rate of leak is proportional to the pressure,

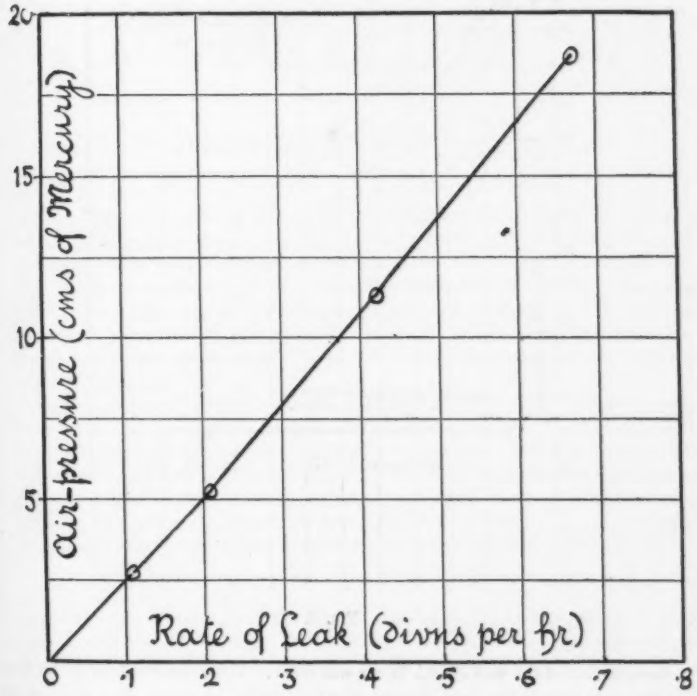

FIG. 5.

so that in a vacuum there would be no leak at all. This shows that the leak is entirely due to the conductivity of the air in the vessel, and that the insulating power of the quartz-rod support is perfect.

Comparison of the Values of the Rate of Leak when the Vessel is immersed, and when it is standing in Air.

In August, 1903, it was not practicable to allow the vessel to remain immersed more than three to four hours, and on calculating the rate of leak from the change of deflection in this time it was impossible to detect any certain change in the rate of

leak produced by the immersion of the vessel. Observations were made at 10 feet, 50 feet, 150 feet, and 230 feet, the vessel touching the bottom of the loch in the last instance.

Later in the year it was practicable to allow longer immersions.

The table on page 441 gives the results of several experiments in which the vessel was immersed for about twelve hours. Between successive immersions a control

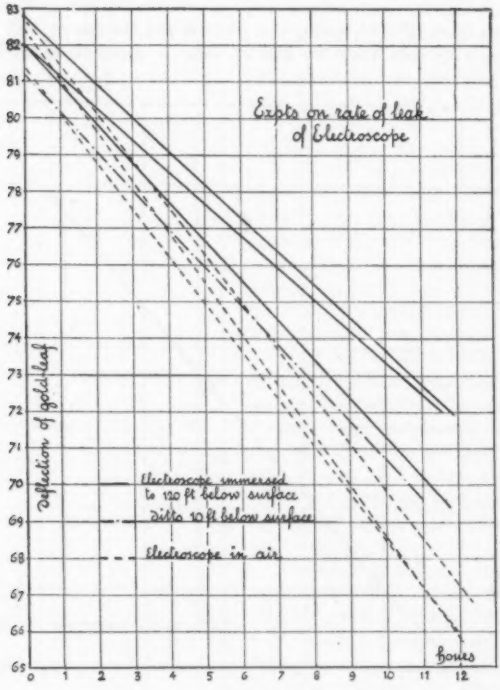

FIG. 6.

determination of the rate of leak in air was made. The vessel was always let down at the same spot in the loch, a point about a quarter of a mile from shore, at the south-west end of the loch. The bottom was about 250 feet below the surface. At the time of the observations the temperature of the water was almost uniform from top to bottom, and about 43° Fahr.

These results are also shown diagrammatically in Fig. 6.

The conclusion which can be drawn from these observations is that by surrounding the vessel with a layer of water 120 feet thick, the conductivity of the air within the vessel is not reduced to less than 75 per cent. of the value which it has when the vessel is standing in air.

Expt. No.	Position of electroscope.	Time.	Deflection of gold-leaf.	Rate of leak (divisions per hour).
I.	120 feet below surface	10 a.m., Dec. 31, 1903	82·8	0·92
		9.50 p.m., Dec. 31, 1903	71·9	
III.	Ditto	10.15 a.m., Jan. 1, 1904	82·0	1·08
		9.55 p.m., Jan. 1, 1904	69·4	
V.	Ditto	10 a.m., Jan. 2, 1904	82·2	0·86
		9.25 p.m., Jan. 2, 1904	72·1	
VII.	10 feet below surface	10.15 a.m., Jan. 4, 1904	81·3	1·07
		9.15 p.m., Jan. 4, 1904	69·5	
II.	In air	10 p.m., Dec. 31, 1903	82·5	1·37
		10.12 a.m., Jan. 1, 1904	65·7	
IV.	In air	9.55 p.m., Jan. 1, 1904	81·5	1·30
		9·50 a.m., Jan. 2, 1904	66·0	
VI.	In air	10.5 p.m., Jan. 2, 1904	82·8	1·28
		10.30 a.m., Jan. 3, 1904	66·8	

IV. SEICHES OBSERVED IN LOCH NESS.

By E. MACLAGAN-WEDDERBURN, M.A.

The first observations on seiches in Scotland were made in 1902 by members of the Lake Survey, the differences in level having been measured by a foot-rule. A Sarasin limnograph was procured by the Survey, and was set up at Fort Augustus on Loch Ness in June, 1903, and has been recording since then, with only a few stoppages. The biggest seiche so far recorded had an amplitude of about 11 cms. The boat-house of St. Benedict's Abbey, kindly put at Sir John Murray's disposal by the Lord Abbot, gave shelter to the instrument both from wind and waves.

Three types of seiches are common on Loch Ness, with periods of approximately 31·5, 15·3, and 8·8 minutes. The first of these is probably the uninodal seiche. It seldom occurs pure, or of any considerable magnitude. This may be due to the influence of Loch Dochfour, which is a continuation of Loch Ness at the north-east end. The two lochs are connected by a narrow channel about 20 feet deep, through which a strong current sometimes flows, and for this reason, in calculating the theoretical period of the seiche, it was thought proper to omit Loch Dochfour.

The period was calculated in two ways. First, by the formula $t = 2\int dl \sqrt{\frac{b}{ag}}$, where b is the breadth and a the area of a cross-section at any particular point. This is the formula obtained by assuming the hypothesis of parallel sections. The value obtained was 42 minutes, which is considerably in excess of the observed value. The period was then calculated by the formula $t = 2\int \frac{dl}{\sqrt{gh}}$, and the value obtained for t was 30·9 minutes, which agrees very closely with the observed value. This method assumes that the period of the seiche would be the same if the shores of the loch rose perpendicularly instead of obliquely.

The binodal seiche, whose period is about 15·3 minutes, is usually very well marked. It is the commonest type, and lasts longer than the uninodal seiche. The node is probably somewhere in the neighbourhood of Inverfarigaig, but has not yet been accurately determined. It is also interesting because its period is less than half the period of the uninodal seiche, although, according to Du Boys, it ought always to be greater than half; and in most lochs it is so, the most notable exception being Lake Geneva. The basin of Loch Ness is so regular that

it is difficult to explain it, as was attempted in the case of Lake Geneva, by assuming an oscillation of part of the loch.

The polynodal seiche, whose period is 8·8 minutes, is always of small amplitude, but sometimes very regular. There are also oscillations of shorter period, but they do not occur regularly enough to allow of their measurement with any degree of accuracy. On one or two occasions there were embroideries on the curve, which may have been due to transverse seiches. Owing to the narrowness of the loch, the period of such a seiche would only be about one minute. These embroideries may be due to a variety of causes, such as the wash of steamers, the opening of the lock-gates in the canal, etc. It will only be possible to determine whether they are vibrations or transverse seiches by simultaneous observations at the two sides of the loch.

The range of atmospheric conditions at Fort Augustus included thunderstorms, and earthquakes also occurred, but these had no very marked influence on the loch. It seems probable that the cause of seiches is sudden local variations of atmospheric pressure; and this view is supported by the records of a barograph at Fort Augustus. The polynodal seiches, and perhaps the uninodal and binodal seiches also, may be started by sudden gusts of wind. The wind blows down the various glens in strong, almost vertical gusts, and this may be sufficient to start the oscillation.

All the speculations, however, regarding the causes of seiches can only be satisfactorily tested by quantitative measurements of the forces at work, and it is hoped that something will be done in this direction in the summer of 1904.

V. BIOLOGY OF LOCH NESS.

By JAMES MURRAY.

The observations made by the members of the Lake Survey during the summer and autumn of 1903 showed that, while every part of the loch, down to the deepest part of the bottom, has its inhabitants, there is one area in which life, if not altogether absent, is very rare. This area is the open water of the loch from a depth of 300 feet to the bottom. Fish may live in this region, but none of the animals obtainable by our nets have been collected in it.

In studying the distribution of organisms in the loch, it is convenient to follow Forel in dividing it into three regions—the Pelagic, the Littoral, and the Abyssal. Each of those regions possesses a distinct association of species.

In the open water of the loch there is a small number of animals and plants, distributed with considerable uniformity throughout. Owing probably to the small annual range of temperature occurring in such a large lake, this pelagic association changes very little throughout the year, the only change observed being the disappearance of a few species in winter. The vertical distribution of the species is very unequal, some having a greater vertical range than others. Life is usually densest at some little distance from the surface (say 20 to 50 feet), but at night there is a distinct migration of many species towards the surface.

The shores of the loch support an abundant flora and fauna. The flowering plants, mosses, and algæ, which grow attached to the rocks or stones of the shore, shelter an immense number of microscopic animals. A great many of the species characteristic of this region extend to a very considerable depth, beyond the limits at which plants cease. The majority of the Entomostraca and many species of Rotifera and other microscopic animals have been dredged at a depth of nearly 300 feet. It is supposed that the abundant deposit of vegetable *débris* on the bottom of the loch takes the place of growing plants in maintaining this rich fauna.

The abyssal fauna includes a few species which are generally distributed all

over the bottom from a depth of 300 feet to the deepest parts of the loch. Below 300 feet the majority of the littoral species cease. A few, such as *Hydra rubra*, some water-mites, and a *Limnæa*, found at depths of from 400 to 600 feet, were so rare that they may be regarded as casually present.

The abyssal fauna includes species representing most of the great groups of aquatic animals. There are Insects, Molluscs, Entomostraca, Worms (Oligochœtes, Turbellarians, Nematodes, and one Rotifer), and Infusoria. These species are not confined to the deeper parts of the loch. The majority of the species range right up to the shore. So far as we have gone, we have found no peculiar species in the abyssal fauna. It seems to be merely an extension of the littoral fauna, including those species which are best able to adapt themselves to the peculiar conditions of the abyssal region. When brought to the surface, the abyssal animals appear to suffer no inconvenience, and thrive well in bottles. A more critical examination of the species by experts may modify our conclusion as to the origin of the abyssal fauna. In one group only, the Rotifers, have we found what may be incipient species, the eyes being often reduced in size or altogether absent.

After the reading of the above papers, Sir John Murray, Lord Belhaven, Prof. Garwood, Dr. H. R. Mill, Mr. Ravenstein, Mr. Chisholm, Mr. Freshfield, and the Chairman took part in a long and interesting discussion on the various problems raised by the communications, and the hope was expressed that these observations and investigations would be continued and extended.

Sir John Murray stated that arrangements were in progress to make a much more detailed investigation of the temperatures and seiches in Loch Ness during the coming summer. All the principal Scottish lochs had now been surveyed, but during next year the survey of the smaller ones would be undertaken, and, so far as possible, completed.

ON MOUNTAINS AND MANKIND.*

By DOUGLAS W. FRESHFIELD.

A GEOGRAPHER or traveller who has been called upon to preside over the meetings of our Section of the British Association may be excused for feeling some hesitation as to the character he shall give to the address which custom compels him to deliver. He cannot but be aware that his audience, while it includes not a few experts, probably far better qualified than himself to take the chair, is composed mainly of those whose concern in geography can only be a general and occasional one.

To compose a summary of the geographical events of the year would be a simple and obvious expedient, were I not conscious that in this I have been forestalled by the indefatigable President of the Royal Geographical Society. Again, to consider the progress of geography during, say, the last quarter of a century, might be instructive to "the general." On the other hand, on his special subject, your President may possibly be able to add something to the common stock by way of observation or suggestion.

Bearing in mind the, from the point of view of posterity, almost excessive energy with which the nineteenth century carried on the exploration of the globe,

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* Presidential Address to the Geographical Section at the Cambridge Meeting of the British Association, August, 1904.

narrowing in every direction the field left to our explorations and our imaginations, 1904 may so far be counted as an *annus mirabilis* in the annals of geography. We have seen the successful return, if not as yet to our own shores, to safe seas, of the most important expedition ever sent South-Polewards. In the success obtained by Captain Scott and his comrades, we have welcomed a full justification of the course taken in putting the supreme command and direction of the undertaking in the hands of an officer of his Majesty's Navy. "England expects every man to do his duty," and I will not indulge in hyperbolical praise, which might be distasteful to men who have shown in trying circumstances the daring, the cheerfulness, and the resourcefulness which we are accustomed to associate with the British Navy. We have every reason to expect that the results obtained by the energetic and capable men of science attached to the expedition will be of wide bearing and interest, but to attempt to estimate them to-day would be obviously premature.

The current year has been distinguished by a, perhaps, even more remarkable geographical event. His Majesty's Government, not satisfied with the laurels it has won in the Antarctic, has embarked on a second geographical adventure on a larger scale, and at a far greater cost (which, however, will presumably be borne by India). It has sent forth a Gold Medallist of the Royal Geographical Society, Colonel Younghusband, with a numerous escort to reach the forbidden capital of Tibet. The saffron-vested monks on the "golden terraces" of the Pota La have seen the glimmer of British bayonets on the horizon, and the castle-palaces of Lhasa will, we hope, open to the military explorer their mysterious halls, hitherto known to us best by the descriptions of that entertaining traveller, my friend Chandra Das.

But the fruits of these great expeditions are not yet ripe. I must leave them to be plucked by my successors. I do so with regret, for in some respects polar exploration is closely akin to mountaineering, and I should have listened with a peculiar interest to an account of the fascinating land, over whose peaks and pastures I lately gazed from the heights of the Jonsong La.

To review the progress of geography during the last twenty-five years, the time that has passed since I first joined the Council of the Royal Geographical Society, is tempting. The retrospect would on the whole be encouraging. The last quarter of a century, if not an era of the most extensive discoveries, has been an era of profitable occupation—I mean profitable in the scientific and not in the commercial sense, though the two are frequently connected—of the ground seized by the great pioneers in Africa, in the backlands of North America, and elsewhere. And when we come to consider the manner in which the results of modern exploration are recorded, what an advance we find! Compare the geographical publications of Great Britain in 1880 and 1904; take the most conspicuous instance, those of the Royal Geographical Society at the two periods. *Petermanns Mitteilungen* was for long the one first-rate geographical magazine in Europe. We have now, as we ought to have had long before, a Journal that rivals it. Consider the way in which our literature and lectures are illustrated by the aid of photography, new processes, and the lantern.

Take a wider survey. Look at maps, beginning with the Ordnance Survey. Compare the last issues of the 1-inch maps, with all the advantages of colour-printing, over their doubtless (except as to roads) accurate, but far less intelligible predecessors. Consider the maps private firms, Messrs. Bartholomew and Messrs. Stanford, have provided us with; note those in the new editions of 'Murray's Guides.'

The correction and completion of maps by new explorations is always desirable.

But it is even more important that a sound system for the delineation of natural features should be adopted both in Government surveys and general maps. I begin to look forward to the day when glaciers will no longer be represented, as they were on the early Indian and Caucasian surveys, without their heads or tails—that is, without either their *névés* or their moraine-cloaked lower portions, or with rivers rising above them and flowing through them. In time, perhaps, every closet cartographer will recognize that glaciers do not lie along the tops of lofty ridges, but descend into valleys. In these matters I have had many an arduous struggle with draftsmen of the highest technical skill, but inadequate out-of-door experience. It is cruel that a poor man should be set to delineate snow mountains who has never seen one, and when "a week at lovely Lucerne" can be had for five guineas, it is inexcusable.

In my schooldays there was an exercise of memory known to us by the contemptuous appellation of "Jog," which boys and teachers united to depreciate and despise. This sentiment is now confined to a few elderly generals and headmasters. Geography flourishes as a branch of science under the august shadow of the elder universities. At Oxford we have produced Prof. Ramsay, Mr. Mackinder, Dr. Herbertson, Mr. Grundy, Mr. Hogarth, Mr. Beazley. We have started a school of geography and a school of geographers. At Cambridge, where Mr. Yule Oldham has worked energetically for the promotion of geography to its proper place in the examinations of the university, a Board of Geographical Studies has been established. I may quote what Sir C. Markham said three months ago—

"The staff of the new geographical school at Cambridge will consist, instead of one reader, of several lecturers and teachers, who will cover the various departments of the science. A diploma in geography will be granted as at Oxford. But Cambridge goes a step further than Oxford, by introducing geography into the examination for the B.A. degree. The importance of according geography such a position in the studies of the universities must be evident to all, and must be specially gratifying to those who, for over thirty years, have fought hard, amid much discouragement, to have geography recognized as a university subject. It will be interesting to see how the Board of Geographical Studies at Cambridge will draw up the detailed regulations for the degree and the diploma, what steps will be taken to secure a competent staff to cover the whole field of our science, and especially to train young university men for practical work in the field. We have every reason to expect that the results will prove satisfactory.

"The Geographical Association of Teachers, of which Mr. Mackinder and Dr. Herbertson are active members, is doing much to enlighten teachers with regard to the capabilities of the subject, to raise its standard, and to introduce improved methods of teaching. An interesting and useful conference was held last winter at the Chelsea Polytechnic under its auspices, and in connection with the conference there was an excellent exhibition of appliances used in teaching geography, the usefulness of which was increased by sending it to various provincial centres."

In primary schools many teachers are furnishing excellent instruction, and are instructing themselves with the help of the many handbooks provided by Dr. Mill, Mr. Chisholm, and others. In the higher branches the problems of scientific geography are studied, and students are encouraged to develop the geographical aspects of other subjects, such as archæology, history, commerce, colonization on the one hand, botany and natural history on the other. We have moved forwards and upwards, but do not let us flatter ourselves that we have as yet reached any considerable eminence. Probably many more of our countrymen

can read a map in this generation than could in the last. A small percentage, I am glad to notice, are not hopelessly bewildered even by contour-lines.

We are learning our geographical alphabet. In time we may, as a nation, be able to read and to understand what we read. We shall recognize that ability to use a map and judge ground is a considerable safeguard against waste of life and disasters in war, and that an acquaintance with the features of the Earth's surface and geographical distribution is an invaluable help in the commercial rivalries and struggles of peace.

When the question of establishing geography at Oxford was being discussed, Dr. Jowett (who had himself somewhere in the fifties suggested the erection of a geographical chair) asked me if I believed geography could be taught so "as to make men think." We should, I believe, "think imperially" to more purpose if we also took pains to "think geographically." But I will not detain you and use up my time by going in any detail into the progress of geography. I might find myself only repeating what others have said better. And as to one important branch, perhaps the most important branch, geographical education, on which I addressed this Section at Birmingham some seventeen years ago, I feel myself debarred by the fact that the Association has now a Section specially devoted to education.

I have determined on the whole, therefore, to run the risk of wearying some of my listeners by inviting your attention to the place in geography of the natural objects which have had for me through life the greatest and most enduring attraction. I propose to talk about mountains, their place in Nature, and their influence, both spiritual and material, on mankind.

We have all of us seen hills, or what we call hills, from the monstrous protuberances of the Andes and the Himalaya to such puny pimples as lie about the edges of your fens. Next to a waterfall, the first natural object (according to my own experience) to impress itself on a child's mind is a hill, some spot from which he can enlarge his horizon. Hills, and still more mountains, attract the human imagination and curiosity. The child soon asks, "Tell me, how were mountains made?" a question easier to ask than to answer, which occupied the lifetime of the father of mountain science, De Saussure. But there are mountains and mountains. Of all natural objects the most impressive is a vast snowy peak rising as a white island above the waves of green hills—a fragment of the arctic world left behind to commemorate its past predominance—and bearing on its broad shoulders a garland of the Alpine flora that has been destroyed on the lower ground by the rising tide of heat and drought that succeeded the last glacial epoch. Midsummer snows, whether seen from the slopes of the Jura or the plains of Lombardy, above the waves of the Euxine or through the glades of the tropical forests of Sikhim, stir men's imaginations and rouse their curiosity. Before, however, we turn to consider some of the physical aspects of mountains, I shall venture, speaking as I am here in a university town, and to a more or less literary audience, to dwell for a few minutes on their place in literature—in the mirror that reflects in turn the mind of the passing ages. For geography is concerned with the interaction between man and Nature in its widest sense. There has been recently a good deal of writing on this subject—I cannot say of discussion, for of late years writers have generally taken the same view. That view is that the love of mountains is an invention of the nineteenth century, and that in previous ages they had been generally looked on either with indifference or positive dislike, rising in some instances to abhorrence. Extreme examples have been repeatedly quoted. We have all heard of the bishop who thought the devil was allowed to put in mountains after the fall of man; of the English scribe in the tenth century who invoked "the bitter blasts of glaciers and

the Pennine host of demons" on the violaters of the charters he was employed to draft. The examples on the other side have been comparatively neglected. It seems time they were insisted on.

The view I hold firmly, and which I wish to place before you to-day, is that this popular belief that the love of mountains is a taste, or, as some would say, a mania, of advanced civilization, is erroneous. On the contrary, I allege it to be a healthy, primitive, and almost universal human instinct. I think I can indicate how and why the opposite belief has been fostered by eminent writers. They have taken too narrow a time-limit for their investigation. They have compared the nineteenth century, not with the preceding ages, but with the eighteenth. They have also taken too narrow a space-limit. They have hardly cast their eyes beyond Western Europe. Within their own limits I agree with them. The eighteenth century was, as we all know, an age of formality. It was the age of Palladian porticoes, of interminable avenues, of formal gardens and formal style in art, in literature, and in dress. Mountains, which are essentially romantic and Gothic, were naturally distasteful to it. The artist says "they will not compose," and they became obnoxious to a generation that adored composition, that thought more of the cleverness of the artist than of the aspects of Nature he used as the material of his work. It was a contented and material century, little stirred by enthusiasms and aspirations and vague desires. There is a great deal to be said for it; it produced some admirable results. It was a phase in human progress, but in many respects it was rather a reaction than a development from what had gone before. Sentiment and taste have their tides like the sea, or, we may here perhaps more appropriately say, their oscillations like the glaciers. The imagination of primitive man abhors a void; it peoples the regions it finds uninhabitable with aëry sprites, with "Pan and father Sylvanus and the sister nymphs;" it worships on high places and reveres them as the abode of Deity. Christianity came and denounced the vague symbolism and personification of Nature in which the pagan had recognized and worshipped the Unseen. It found the objects of its devotion, not in the external world, but in the highest moral qualities of man. Delphi heard the cry, "Great Pan is dead!" But the voice was false. Pan is immortal. Every villager justifies etymology by remaining more or less of a pagan. Other than villagers have done the same. The monk driven out of the world by its wickedness fell in love with the wilderness in which he sought refuge, and soon learnt to give practical proof of his love of scenery in his choice of sites for his religious houses. But the literature of the eighteenth century was not written by monks or country folk, or by men of world-wide curiosity and adventure like the Italians of the Renaissance or our Elizabethans. It was the product of a practical common-sense epoch which looked on all waste places, heaths like Hindhead, or hills like the Highlands, as blemishes in the scheme of the universe, not having yet recognized their final purpose as golf-links or gymnasiums. Intellectual life was concentrated in cities and courts; it despised the country. Books were written by townsmen, dwellers in towns which had not grown into vast cities, and whose denizens, therefore, had not the longing to escape from their homes into purer air that we have to-day. They abused the Alps frankly. But all they saw of them was the comparatively dull carriage passes, and these they saw at the worst time of year. Hastening to Rome for Easter, they traversed the Maurienne while the ground was still brown with frost and patched untidily with half-melted snowdrifts. It is no wonder that Gray and Richardson, having left spring in the meadows and orchards of Chambéry, grumbled at the wintry aspect of Lanslebourg.

That at the end of the eighteenth century a literary lady of Western Europe

preferred a Paris gutter to the Lake of Geneva is an amusing caricature of the spirit of the age that was passing away, but it is no proof that the love of mountains is a new mania, and that all earlier ages and peoples looked on them with indifference or dislike. Wordsworth and Byron and Scott in this country, Rousseau and Goethe, De Saussure and his school abroad, broke the ice, but it was the ice of a winter frost, not of a glacial period.*

Consider for a moment the literature of the two peoples who have most influenced European thought—the Jews and the Greeks. I need hardly quote a book that before people quarrelled over education was known to every child—the Bible. I would rather refer you to a delightful poem in rhyming German verse written in the seventeenth century by a Swiss author, Rebman, in which he relates all the great things that happened on mountains in Jewish history: how Solomon appreciated the charms of Lebanon; how Moses and Elias both disappeared on mountain-tops; how kings and prophets found their help among the hills; how closely the heights of Palestine are connected with the story of the Gospels.

Consider, again, Greece, where I have just been wandering. Did the Greeks pay no regard to their mountains? They seized eagerly on any striking piece of hill scenery and connected it with a legend or a shrine. They took their highest mountain, broad-backed Olympus, for the home of the gods; their most conspicuous mountain, Parnassus, for the home of poetry. They found in the cliffs of Delphi a dwelling for their greatest oracle and a centre for their patriotism. One who has lately stood on the top of Parnassus and seen the first rays of the sun as it springs from the waves of the Ægean strike its snows, while Attica and Bœotia and Eubœa still lay in deep shadow under his feet, will appreciate the famous lines of Sophocles, which I will not quote, as I am uncertain how you may pronounce Greek in this university. You may remember, too, that Lucian makes Hermes take Charon, when he has a day out from Hell, to the twin-crested summit, and show him the panorama of land and sea, of rivers and famous cities. The Vale of Tempe, the deep gap between Olympus and Ossa, beautiful in its great red cliffs, fountains, and spreading plane-trees, was part of a Roman's classical tour. The superb buttresses in which Taygetus breaks down on the valley of the Eurotas were used by the Spartans for other purposes besides the disposal of criminals and weakly babies. The middle regions—the lawns above the Langada Pass, "virginibus bacchata Lacænis Taygeta"—are frequented to this day as a summer resort by Spartan damsels. The very top, the great rock that from a height of 8000 feet looks down through its woods of oaks and Aleppo pines on the twin bays of the southern sea, is a place of immemorial pilgrimage. It is now occupied by a chapel framed in a tiny court, so choked with snow at the beginning of June that I took the ridge of the chapel roof for a dilapidated stoneman. I have no time to-day to look for evidence in classical literature, to refer to the discriminating epithets applied in it to mountain scenes.†

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* Even in the eighteenth century a great deal of interest was taken in mountain phenomena. M. le Baron de Zurlauben's splendid work, 'Tableaux de la Suisse,' published in 1781, has numerous plates illustrating glaciers, and its index contains nearly three long columns of references to them.

† Cicero puts together a list of rural delights ('De Naturâ Deorum,' ii. 39), "Fontium gelidas perennitates, liquores pellucidos amnium, ripárum vestitus viridissimos, speluncarum concavas altitudines, *saxorum asperitates, impendentium montium altitudines*, immensitatesque camporum." Apuleius, in his treatise 'De Mundo,' arguing in favour of physiography, quotes as amongst the common objects of picturesque description in the second century, "Nysæ juga, et penetralia Coryci, et Olympi sacra, et Ossæ ardua, et alia hujuscemodi."

A third race destined apparently to play a great part in the world's history —the Japanese—are ancient mountain lovers. We are all aware that Fujiyama to the Japanese is (as Ararat to the Armenians) a national symbol; that its ascent is constantly made by bands of pilgrims; that it is depicted in every aspect. Those who have read the pleasant book of Mr. Weston, who, as English chaplain at Kobi for some years, had exceptional opportunities of travel in the interior, will remember how often he met with shrines and temples on the summits of the mountains, and how he found pilgrims who frequented them in the belief that they fell there more readily into spiritual trances. The Japanese Minister, when he attended Mr. Weston's lecture at the Alpine Club, told us that his countrymen never climbed mountains without a serious — that is to say, a religious—object.

India and China would add to my evidence had I knowledge and time enough to refer to their literature. I remember Tennyson pointing out to me in a volume of translations from the Chinese a poem, written about the date of King Alfred, in praise of a picture of a mountain landscape. But I must return to the sixteenth and seventeenth centuries in Europe; I may go earlier—even back to Dante. His allusions to mountain scenery are frequent; his Virgil had all the craft of an Alpine rock-climber. Read Leonardo da Vinci's 'Notes,' Conrad Gesner's ascent of Pilatus; study the narratives of the Alpine precursors Mr. Coolidge has collected and annotated with admirable industry in the prodigious volume he has recently brought out.

It is impossible for me here to multiply proofs of my argument, to quote even a selection from the passages that show an authentic enthusiasm for mountains that may be culled from writers of various nations prior to A.D. 1600. I must content myself with the following specimens, which will probably be new to most of my hearers.

Benedict Marti was a professor of Greek and Hebrew at Bern, and a friend of the great Conrad Gesner (I call him great, for he combined the qualities of a man of science and a man of letters, was one of the fathers of botany as well as of mountaineering, and, in his many-sidedness, a typical figure of the Renaissance). Marti, in the year 1558 or 1559, wrote as follows of the view from his native city:—

"These are the mountains which form our pleasure and delight" (the Latin is better—"deliciæ nostræ, nostrique amores") "when we gaze at them from the higher parts of our city and admire their mighty peaks and broken crags that threaten to fall at any moment. Here we watch the risings and settings of the sun and seek signs of the weather. In them we find food not only for our eyes and our minds, but also for our bellies;" and he goes on to enumerate the dairy products of the Oberland and the happy life of its population. I quote again this good man: "Who, then, would not admire, love, willingly visit, explore, and climb places of this sort? I assuredly should call those who are not attracted by them dolts, stupid dull fishes, and slow tortoises" ("fungos, stupidos insulsos pisces, lentosque chelones"). "In truth, I cannot describe the degree of affection and natural love with which I am drawn to mountains, so that I am never happier than on the mountain crests, and there are no wanderings dearer to me than those on the mountains. . . . They are the theatre of the Lord, displaying monuments of past ages, such as precipices, rocks, peaks and chasms and never-melting glaciers;" and so on through many eloquent paragraphs.

I will only add two sentences from the preface to Simler's 'Vallesiæ et Alpium Descriptio,' first published in 1574, which seem to me a strong piece of evidence in favour of my view: "In the entire district, and particularly in the very lofty

ranges by which the Vallais is on all sides surrounded, wonders of Nature offer themselves to our view and admiration. With my countrymen many of them have through familiarity lost their attraction; but foreigners are overcome at the mere sight of the Alps, and regard as marvels what we through habit pay no attention to."

Mr. Coolidge, in his singularly interesting footnotes, goes on to show that the books that remain to us are not isolated instances of a feeling for mountains in the age of the Renaissance. The mountains themselves bear, or once bore, records even more impressive. Most of us have visited the picturesque old castle at Thun and seen beyond the rushing Aar the green heights of the outposts of the Alps, the Stockhorn, and the Niesen. Our friend Marti, who climbed the former peak about 1558, records that he found on the summit "tituli, rythmi, et proverbia saxis inscripta unà cum imaginibus et nominibus auctorum. Inter alia cujusdam docti et montium amœnitate capti observare licebat illud—

"'Ο τῶν ὀρῶν ἔρως ἄριστος."

"The love of mountains is best." In those five words some Swiss professor anticipated the doctrine of Ruskin and the creed of Leslie Stephen, and of all men who have found mountains the best companions in life.

In the annals of art it would be easy to find additional proof of the attention paid by men to mountains three to four hundred years ago. The late Josiah Gilbert, in a charming but too little-known volume, 'Landscape in Art,' has shown how many great painters depicted in their backgrounds their native hills. Titian is the most conspicuous example.

It will perhaps be answered that this love of mountains led to no practical result, bore no visible fruit, and therefore can have been but a sickly plant. Some of my hearers may feel inclined to point out that it was left to the latter half of the nineteenth century to found Climbers' Clubs. It would take too long to adduce all the practical reasons which delayed the appearance of these fine fruits of peace and an advanced civilization. I am content to remind you that the love of mountains and the desire to climb them are distinct tastes. They are often united, but their union is accidental, not essential. A passion for golf does not necessarily argue a love of levels. And I would suggest that more outward and visible signs than are generally imagined of the familiar relations between men and mountains in early times may be found. The choicest spots in the Alpine region—Chamonix, Engelberg, Disentis, Einsiedlen, Pesio, the Grande Chartreuse—were seized on by recluses; the Alpine Baths were in full swing at quite an early date. I will not count the Swiss Baden, of which a geographer, who was also a Pope, Æneas Silvius (Pius II.), records the attractions, for it lies under the Jura, not the Alps; but Pfäfers, where wounded warriors went to be healed, was a scene of dissipation, and the waters of St. Moritz were vaunted as superseding wine. I may be excused, since I wrote this particular passage myself a good many years ago, for quoting a few sentences bearing on this point from 'Murray's Handbook to Switzerland.' In the sixteenth century fifty treatises dealing with twenty-one different resorts were published. St. Moritz, which had been brought into notice by Paracelsus (died 1541), was one of the most famous baths. In 1501 Matthew Schiner, the famous Prince Bishop of Sion, built "a magnificent hotel" at Leukerbad, to which the wealthy were carried up in panniers on the back of mules. Brieg, Gurnigel, near Bern, the Baths of Masino, Tarasp, and Pfäfers were also popular in early times. Leonardo da Vinci mentions the baths of Bormio, and Gesner went there.

It is not, however, with the emotional influences or the picturesque aspect of mountains that science concerns itself, but with their physical examination.

If I have lingered too long on my preamble I can only plead as an excuse that a love of one's subject is no bad qualification for dealing with it, and that it has tempted me to endeavour to show you grounds for believing that a love of mountains is no modern affectation, but a feeling as old and as widespread as humanity itself.

Their scientific investigation has naturally been of comparatively modern date. There are a few passages about the effects of altitude, there are orographical descriptions more or less accurate in the authors of antiquity. But for attempts to explain the origin of mountains, to investigate and account for the details of their structure, we shall find little before the notes of Leonardo da Vinci, that marvellous man who combined, perhaps, more than any one who has ever lived the artistic and the scientific mind. His ascent of Monte Boso about 1511, a mountain which may be recognized under this name on the Italian ordnance map on the spur separating Val Sesia and the Biellese, was the first ascent by a physical observer. Gesner, with all his mountain enthusiasm, found a scientific interest in the Alps mainly, if not solely, in their botany.

The phenomenon which first drew men of science to Switzerland was the Grindelwald glaciers—"miracles of Nature" they called them. Why these glaciers in particular, you may ask, when there are so many in the Alps? The answer is obvious. Snow and ice on the "mountain-tops that freeze" are no miracle. But when two great tongues of ice were found thrusting themselves down among meadows and corn and cottages, upsetting barns and covering fields and even the marble quarries from which the citizens of Bern dug their mantelpieces, there was obviously something outside the ordinary processes of Nature, and therefore miraculous.

Swiss correspondents communicated to our own Royal Society the latest news as to the proceedings of these unnatural ice-monsters, while the wise men of Zürich and Bern wrote lectures on them. Glacier theories began. Early in the eighteenth century Hottinger, Cappeller, Scheuchzer, that worthy man who got members of our Royal Society to pay for his pictures of flying dragons, contributed their quota of crude speculation. But it was not till 1741 that Mont Blanc and its glaciers were first brought into notoriety by our countrymen, Pococke and Windham, and became an attraction to the mind and an object to the ambition of the student whose name was destined to be associated with them. Horace Benedict de Saussure, born of a scientific family, the nephew of Bonnet, the Genevese botanist and philosopher, who has become known to the world as a mountaineer and the climber of Mont Blanc, came twenty years later. In truth he was far more of a mountain traveller and a scientific observer, a geological student, than a climber. When looking at his purple silk frock-coat (carefully preserved in his family's country home on the shore of the Lake of Geneva), one realizes the difference between the man who climbed Mont Blanc in that garment and the modern gymnast who thinks himself *par excellence* the mountaineer.

De Saussure did not confine his travels to Savoy or to one group; he wandered far and wide over the Alpine region, and the four volumes of his 'Voyages' contain, besides the narratives of his sojourn on the Col du Géant and ascent of Mont Blanc, a portion of the fruit of these wanderings.

The reader who would appreciate De Saussure's claim as the founder of the Scientific Exploration of Mountains must, however, be referred to the List of Agenda on questions calling for investigation placed at the end of his last volume. It explains the comparative indifference shown by De Saussure to the problems connected with glacial movement and action. His attention was absorbed in the larger question of earth-structure, of geology, to which the sections exposed by

mountains offered, he thought, a key; he was bitten by the contemporary desire for "A Theory of the Earth," by the taste of the time for generalizations for which the facts were not always ready. At the same time, his own intellect was perhaps somewhat deficient in the intuitive faculty; the grasp of the probable or possible bearing of known facts by which the greatest discoverers suggest theories first and prove them afterwards.

The school of De Saussure at Geneva died out after having produced Bourrit, the tourist who gloried in being called the Historian of the Alps, a man of pleasant self-conceit and warm enthusiasm, and De Luc, a mechanical inventor, who ended his life as reader to Queen Charlotte at Windsor, where he flits across Miss Burney's pages as the friend of Herschel at Slough and the jest of tipsy royal dukes. Oddly enough, the first sound guess as to glacier movement was made by one Bordier, who had no scientific pretensions. I reprinted many years ago the singular passage in which he compared glacier ice to "cire amollie," soft wax, "flexible et ductile jusqu'à un certain point," and described it as flowing in the manner of liquids (*Alp. Journal*, ix. 327). He added this remarkable suggestion foreshadowing the investigations of Prof. Richter and M. Forel: "It is very desirable that there should be at Chamonix some one capable of observing the glaciers for a series of years and comparing their advance and oscillations with meteorological records." To the school of Geneva succeeded the school of Neuchatel, Desor, and Agassiz; the feat of De Saussure was rivalled on the Jungfrau and the Finsteraarhorn by the Meyers of Bern. They in turn were succeeded by the British school, Forbes and Tyndall, Reilly and Wills, in 1840–60.

In 1857 the Alpine Club was founded in this country. In the half-century since that date the nations of Western Europe have emulated one another in forming similar bodies, one of the objects of which has been to collect and set in order information as to the mountains, and to further their scientific as well as their geographical exploration.

What boulders, or rather pebbles, may we profitably add to the enormous moraine of modern Alpine literature—a moraine of which it is to be hoped for the sake of posterity that the torrent of time may speedily make away with some of the lighter portions.

For fifty years I have loved and at frequent intervals wandered and climbed in the Alps. I have had something of a grand passion for the Caucasus. I am on terms of visiting acquaintance with the Pyrenees and the Himalaya, the Apennines and the Algerian Atlas, the mountains of Greece, Syria, Corsica, and Norway. I will try to set in order some observations and comparisons suggested by these various experiences.

As one travels east from the Atlantic through the four great ranges of the Old World the peaks grow not only in absolute height, but also in abruptness of form, and in elevation above the connecting ridges. The snow and ice region increases in a corresponding manner. The Pyrenees have few fine rockpeaks except the Pic du Midi d'Ossau; their chief glacier summits, the Vignemale, Mont Perdu, the Maladetta, correspond to the Titlis or the Buet in the Alps. The peaks of the Alps are infinite in their variety and admirable in their clear-cut outlines and graceful curves. But the central group of the Caucasus, that which culminates in Dykhtau, Koshtantau, and Shkara, 17,000-feet summits (Koshtantau falls only 120 feet below this figure), has even more stately peaks than those that cluster round Zermatt.

Seek the far eastern end of the Himalaya, visit Sikhim, and you will find the scale increased; Siniolchum, Jannu, and Kangchenjunga are all portentous giants. To put it at a low average figure, the cliffs of their final peaks are half as high again as those of Monte Rosa and the Matterhorn.

In all these chains you will find the same feature of watersheds or partings lying not in but behind the geological axis. This is the case in the Alps at the St. Gotthard, in the Caucasus for some 40 miles west of the Dariel pass, in the Himalaya, in Sikhim and Nepal, where the waters flowing from the Tibetan plateau slowly eat their way back behind Kangchenjunga and the Nepalese snows. The passes at their sources are found consequently to be of the mildest character, hills "like Wiltshire downs," is the description given by a military explorer. It needs no great stretch of geological imagination to believe in the cutting back of the southern streams of Sikhim or the Alps, as, for instance, at the Maloya; but I confess that I cannot see how the gorges of Ossetia—clefts cut through the central axis of the Caucasus—can be ascribed mainly to the action of water.

I turn to the snow-and-ice region. Far more snow is deposited on the heights of the Central Caucasus and the Eastern Himalaya than on the Alps. It remains plastered on their precipices, forming hanging glaciers everywhere of the kind found on the northern, the Wengern Alp, face of the Jungfrau. Such a peak as the Weisshorn looks poor and bare compared with Tetnuld in the Caucasus or Siniolchum in the Himalaya. The plastered sheets of snow between their great bosses of ice are perpetually melting; their surfaces are grooved, so as to suggest fluted armour, by tiny avalanches and runnels.

In the Aletsch glacier the Alps have a champion with which the Caucasus cannot compete; but, apart from this single exception, the Caucasian glaciers are superior to the Alpine in extent and picturesqueness. Their surfaces present the features familiar to us in the Alps—icefalls, moulins, and earthcones.

In Sikhim, on the contrary, the glaciers exhibit many novel features, due no doubt mainly to the great sun-heat. In the lower portion their surface is apt to be covered with the *débris* that has fallen from the impending cliffs, so that little or no ice is visible from a distance. In the region below the *névé* there are very few crevasses; the ice heaves itself along in huge and rude undulations, high gritty mounds, separated by hollows often occupied by yellow pools which are connected by streams running in little icy ravines—a region exceptionally tiresome, but in no way dangerous to the explorer. In steep places the Alpine icefall is replaced by a feature I may best compare with a series of earth-pillars such as are found near Evolena and elsewhere, and are figured in most text-books. The ice is shaped into a multitude of thin ridges and spires, resembling somewhat the Nieves Penitentes of the Andes—though formed in a different material.

Great sun-heat acting on surfaces unequally protected, combined in the latter case with the strain of sudden descent, is no doubt the cause of these phenomena. Generally the peculiarities of the great glaciers of Kangchenjunga may be attributed to a fiercer sun, which renders the frozen material less liable to crack, less rigid, and more plastic.

A glacier, as a rule, involves a moraine. Now, moraines are largely formed from the material contributed by sub-aërial denudation—in plain words, by the action of heat and cold and moisture on the cliffs that border them. It is what falls on a glacier, not that which it falls over, that mainly makes a moraine. The proof is that the moraines of a great glacier which flows under no impending cliffs are puny, compared with those of a little one that lies beneath great rockwalls.

Take, for example, the Norwegian glaciers of the Jostedal's Brae and compare them with the Swiss. The former, falling from a great *névé* plain or snowfield, from which hardly a crag protrudes, are models of cleanliness. I may cite as examples the three fascinating glaciers of the Olden valley. The Rosenlaui glacier in Switzerland owed the purity which gave it a reputation fifty years ago,

before its retirement from tourists' tracks, to a similar cause—its source in a vast snow-plateau, the Wetterkessel.

One peculiarity very noticeable both in the Himalaya and the Caucasus I have never found satisfactorily accounted for. I refer to the long grassy trenches lying between the lateral moraine and the mountain-slope, which often seem to the explorer to have been intended by Providence to form grass paths for his benefit. They may possibly be due to the action of torrents falling from the hillside, which, meeting the moraine and constantly sweeping along its base, undermine it and keep a passage open for themselves. There are remarkable specimens of this formation on both sides of the Bezingi glacier, in the Caucasus, and on the north side of the Zemu glacier in Sikhim.

Water is one of the greatest features in mountain scenery. In Norway it is omnipresent. In this respect Scandinavia is a region apart; the streams of the more southern ranges are scanty compared with those of a region where the snow-fall of two-thirds of the year is discharged in a few weeks. Greece stands at the opposite pole. By what seems a strange perversity of Nature, its slender streams are apt to disappear underground, to reissue miles away in the great fountains that gave rise to so many legends. Arcadia is, for the most part, a dry upland, sadly wanting in the two elements of pastoral scenery, shady groves, and running brooks.

The Alps are distinguished by their sub-alpine lakes—

> "Anne lacus tantos; te, Lari maxime, teque
> Fluctibus et fremitu assurgens, Benace, marino?"

of Virgil. But perhaps even more interesting to the student are the lake-basins that have been filled up, and thus suggest how similar lakes may have vanished at the feet of other ranges.

I know no more striking walk to any one interested in the past doings of glaciers than that along the ridge of the mighty moraine of the old glacier of Val d'Aosta, which sweeps out, a hill 500 feet high, known as "La Serra," from the base of the Alps near Ivrea into the plain of Piedmont. Enclosed in its folds still lies the Lago di Viverone; but the Dora has long ago cut a gap in the rampart and drained the rest of the enclosed space, filling it up with the fluvial deposit of centuries.

It is, however, the tarns rather than the great lakes of the Alps which have been the chief subjects of scientific disputation. Their distribution is curious. They are found in great quantity in the Alps and Pyrenees, hardly at all in the Caucasus, and comparatively rarely in the part of the Himalaya I am acquainted with.

A large-scale map will show that where tarns are most thickly dotted over the uplands the peaks rise to no great height above the ridges that connect them. This would seem to indicate that there has been comparatively little sub-aërial denudation in these districts, and consequently less material has been brought down to fill the hollows. Again, it is in gneiss and granitic regions that we find tarns most abundant—that is, where the harder and more compact rocks make the work of streams in tapping the basins more lengthy. The rarity of tarns in the highlands behind Kangchenjunga, perhaps, calls for explanation. We came upon many basins, but, whether formed by moraines or true rock-basins, they had for the most part been filled up by alluvial deposits.

In my opinion, the presence of tarns must be taken as an indication that the portion of the range where they are found has until a comparatively recent date been under snow or ice. The former theory, still held, was that the ice scooped

out their basins from the solid rock. I believe that it has simply kept scoured pre-existing basins. The ice removed and the surrounding slopes left bare, streams on the one hand have filled the basins with sediment, or, on the other, tapped them by cutting clefts in their rims. This theory meets, at any rate, all the facts I have observed, and I may point out that the actual process of the destruction of tarns by such action may be seen going on under our eyes in many places, notably in the glens of the Adamello group. Professor Garwood has lately employed his holidays in sounding many of the tarns of the St. Gotthard group, and his results, I understand, tend to corroborate the conclusions just stated.

I desire here to reaffirm my conviction that snow and ice in the High Alps are conservative agents; that they arrest the natural processes of subaërial denudation; that the scouring work done by a glacier is insignificant compared with the hewing and hacking of frost and running water on slopes exposed to the open sky without a roof of *névé* or glacier.

The contrast between the work of these two agents was forced upon me many years ago while looking at the ground from which the Eiger glacier had then recently retreated. The rocks, it is true, had had their angles rubbed off by the glacier, but through their midst, cut as by a knife, was the deep slit or gash made by the subglacial torrent. There is in the Alps a particular type of gorge, found at Rosenlaui, at the Lower Grindelwald glacier, at the Kirchet above Meiringen, and also in the Caucasus, within the curves of old terminal moraines. It is obviously due to the action of the subglacial torrent, which cuts deeper and deeper, while the ice above protects the sides of the cutting from the action of the atmosphere.

One more note I have to make about glaciers. It has been stated that glaciers go on melting in winter. Water, no doubt, flows from under some of them, but that is not the same thing. In January the end of the Rosenlaui glacier is dry; you can jump across the clear stream that flows from the Lower Grindelwald glacier. That stream is not meltings, but the issue of a spring which rises under the glacier and does not freeze. There is another such stream on the way to the Great Scheideck, which remains free when frost has fettered all its neighbours.

I should like to draw your attention before we leave glaciers to the systematic efforts that are being made on the Continent to extend our knowledge of their peculiarities. The subject has a literature of its own, and two societies—one in France, one in other countries—have been constituted to promote and systematize further investigations, especially with regard to the secular and annual oscillations of the ice. These were initiated by the English Alpine Club in 1893, while I was its president. Subsequently, through the exertions of the late Marshall Hall, an enthusiast on the subject, an International Commission of Glaciers was founded, which has been presided over by Dr. Richter, M. Forel, and others; and more recently a French Commission has been created with the object of studying in detail the glaciers of the French Alps. A number of excellent reports have been published, embodying information from all parts of the globe. There has been, and is, I regret to say, very great difficulty in obtaining any methodical reports from the British possessions oversea. The subject does not commend itself to the departmental mind. Let us hope for improvement: I signalize the need for it. Of course, it is by no means always an easy matter to get the required measurements of retreat or advance in the glacial snout, when the glacier is situated in a remote and only casually visited region. Still, with good-will more might be done than has been. The periods of advance and retreat of glaciers appear to correspond to a certain extent throughout the globe. The middle of the last century was the culmination of the last great advance. The general estimate of their duration appears to be half a century. The ice is now retreating in the Alps, the Caucasus,

and the Himalaya, and I believe in North America. We live in a retrogressive period. The minor oscillation of advance which a few years ago gave hopes to those who, like myself, had as children seen the glaciers of Grindelwald and Chamonix at their greatest, has not been continued.

Attempts are made to connect the oscillations of glaciers with periods of sunspots. They are, of course, connected with the rain or snowfall in past seasons. But the difficulty of working out the connection is obvious.

The advance of the glacier will not begin until the snows falling in its upper basin have had time to descend as ice and become its snout; in each glacier this period will vary according to its length, bulk, and steepness, and the longer the glacier is, the slower its lower extremity will be to respond. Deficiency in snowfall will take effect after the same period. It will be necessary, therefore, to ascertain (as has been done in a tragic manner on Mont Blanc by the recovery in the lowest portion of the Glacier des Bossons of the bodies of those lost in its highest snows) the time each glacier takes to travel, and to apply this interval to the date of the year with which the statistics of deposition of moisture are to be compared. If the glacier shows anything about weather and climate, it is past, not contemporary, weather it indicates.

Another point in which the Asiatic ranges, and particularly the Himalaya, differ from the Alps is in the frequency of snow avalanches, earthfalls, and mudslides. These are caused by the greater deposition of snow and the more sudden and violent alternations of heat and cold, which lead to the splitting of the hanging ice and snows by the freezing of the water in their pores. I have noticed at bivouacs that the moment of greatest cold—about the rising of the morning star—is often hailed by the reports of a volley of avalanches.

The botanist may find much to do in working out a comparison of the flora of my four ranges. I am no botanist: I value flowers according, not to their rarity, but to their abundance, from the artist's, not the collector's, point of view. But it is impossible not to take interest in such matters as the variations of the gentian in different regions, or the behaviour of such a plant as the little Edelweiss (once the token of the Tyrolese lover, now the badge and bane of the Alp-trotter), which frequents the Alps, despises the Caucasus, reappears in masses in the Himalaya, and then, leaping all the isles of the tropics, turns up again under the snows of New Zealand. I may mention that it is a superstition that it grows only in dangerous places. I have often found it where cows can crop it; it covers acres in the Himalaya, and I believe it has been driven by cows off the Alpine pastures, as it is being driven by tourists out of the Alps altogether.

The Italian botanists, MM. Levier and Sommier, have given a vivid account of what they call the Makroflora of the Central Caucasus—those wild-flower beds, the product of sudden heat on a rich and sodden soil composed of the vegetable mould of ages, in which a man and horse may literally be lost to sight. Has any competent hand celebrated the Mikroflora of the highest ridges, those tiny, vivid forget-me-nots and gentians and ranunculuses that flourish on rock-island "Jardins" like that of Mont Blanc, among the eternal snows, and enamel the highest rocks of the Basòdino and the Lombard Alps? A comprehensive work on a comparison of mountain flora and the distribution of Alpine plants throughout the ranges of the Old World would be welcome. We want another John Ball. Allied to botany is forestry, and the influence of trees on rainfall, and consequently the face of the mountains, a matter of great importance, which in this country has hardly had the attention it deserves.

From these brief suggestions as to some of the physical features of mountains I would ask you to turn your attention to the points in which mankind come in contact with them, and first of all to history.

I fancy that the general impression that they have served as efficient barriers is hardly in accordance with facts, at any rate from the military point of view. Many great captains—Hannibal, Hasdrubal, Cæsar, Charles the Great, and Napoleon—passed the Alps successfully. Hannibal, it is true, had some difficulty, but then he was handicapped with elephants. Many years ago I showed that Servius, the greatest authority in Rome in the days of Augustus, had no doubt as to where Hannibal crossed the Alps, and proved that it was not by any Aostan pass.* The Holy Roman emperors constantly moved forwards and backwards. Burgundy, as the late Mr. Freeman was never weary of insisting, lay across the Alps. So till our own day did the dominions of the House of Savoy. North Italy has been in frequent connection with Germany; it is only in my own time that the Alps have become a frontier between France and Italy. But questions of this kind might lead us too far. Let me suggest that some competent hand should compose a history of the Alpine passes and their famous passages, more complete than the treatises that have appeared in Germany. Mr. Coolidge, to whom we owe so much, has, in his monumental collection and reprint of early Alpine writers, just published, thrown great light on the extensive use of what I may call the by-passes of the Alps in early times. Will he not follow up his work by treating of the Great Passes? I may note that the result of the construction of carriage roads over some of them was to concentrate traffic; thus the Saas passes and the Gries were practically deserted for commercial purposes when Napoleon opened the Simplon. The roads over the Julier and Maloya ruined the Septimer. Another hint to those engaged in tracing ancient lines of communication. In primitive times, in the Caucasus to-day, the tendency of paths is to follow ridges, not valleys. The motives are on the spot obvious—to avoid torrents, swamps, ravines, earthfalls, and to get out of the thickets and above the timber-line. The most striking example is the entrance to the great basin of Suanetia, which runs not up its river, the Ingur, but across a ridge of over 9000 feet, closed for eight months in the year to animals.

From the military point of view mountains are now receiving great attention in Central Europe. The French, the Italians, the Swiss, the Austrians have extensive Alpine manœuvres every summer, in which men, mules, and light artillery are conveyed or carried over rocks and snow. Officers are taught to use maps on the spot; the defects in the official surveys are brought to light. It is not likely, perhaps, except on the Indian frontier, that British troops will have to fight among high snowy ranges. But I feel sure that any intelligent officer who is allowed to attend such manœuvres might pick up valuable hints as to the best equipment for use in steep places. Probably the Japanese have already sent such an envoy and profited by his experience.

A word as to maps, in which I have taken great interest, may be allowed me. The ordnance maps of Europe have been made by soldiers, or under the supervision of soldiers. At home when I was young, it was dangerous to hint at any defects in our ordnance sheets, for surveyors in this country are a somewhat sensitive class. Times have altered, and they are no longer averse from receiving hints and even help from unofficial quarters. Since the great surveys of Europe were executed, knowledge has increased, so that every country has had to revise or re-execute its surveys. In three points that concern us there was great room for improvement—the delineation of the upper region as a whole, and the definition of snow and glaciers in particular, and in the selection of local names. In the two former the Federal Staff at Bern has provided us with an incomparable model. The number

* See *Alpine Journal*, Nos. 81, 89; *P.R.G.S.*, October, 1886, and May, 1899.

of local names known to each peasant is small, his pronunciation is often obscure and each valley is apt to have its own set of names for the ridges and gaps that form its skyline. Set a stranger, speaking another tongue than the local *patois*, to question a herdsman, and the result is likely to be unsatisfactory. It has often proved so. The Zardezan is an odd transcription of the Gias del Cian of *patois*, the Gîte du Champ in French. Grand Paradis is probably a corruption of Granta Parei, an apt description of the great screen of rock and ice of the highest mountain in Italy, though that name is now given to a neighbouring peak. The Pointe de Rosablanche was formerly the Roesa Bianca, or white glacier. Monte Rosa herself, though the poet sees a reference to the rose of dawn, and the German professor detects "the Keltic *ros*, a promontory," is a simple translation of the Gletscher Mons of Simler, or rather Simler's hybrid term is a translation of Monte della Roesa. Roesa, or Ruize, is the Val d'Aostan word for glacier, and may be ound in De Saussure's 'Voyages.'

An important case in this matter of mountain nomenclature has recently come under discussion—that of the highest mountain in the world. Most, if not all, mountaineers regret that the name of a Surveyor-General, however eminent, was fifty years ago affixed to Mount Everest. The ground for this action on the part of the Survey was the lack of any native name. Some years ago I ventured to suggest that the 29,002-feet peak (No. XV. of the Survey) was probably visible from the neighbourhood of Katmandu, even though the identifications of it by Schlagintweit and others might be incorrect, and that since some at least of the summits of the snowy group east of that city are apparently known in Nepal as Gaurisankar, that name might, following the practice which gave its name to Monte Rosa in the Alps, legitimately be applied to the loftiest crest of the mountain group of which the Nepalese Gaurisankar formed a part.

Recently, by the kindness of Lord Curzon, acting on a suggestion of my own, Captain Wood, a Survey officer, has been deputed to visit Katmandu and ascertain the facts. He has found that, contrary to the opinion of the late General Walker and the assertion of Major Waddell, Peak XV. is visible from the hills round the capital, and that the two highest snow-peaks visible from the city itself in the same direction were known to the Nepalese "nobles" as Gaurisankar.*

These latter peaks or peak are about 36 miles distant from Peak XV., but are connected with it by a continuous line of glaciers. According to the principles that have prevailed in the division of the Alps, they would undoubtedly be considered as part of the same group, and the name, which, according to Captain Wood, is applied to a portion of the group, might legitimately be adopted for its loftiest peak.

But the chiefs of the Indian Survey take, as they are entitled to, a different view. They have decided to confine the name Gaurisankar to one of the peaks seen from Katmandu itself. I do not desire to raise any further protest against this decision. For since, in 1886, I first raised the question, its interest has become mainly academical. A local Tibetan name for Peak XV., Chomo-Kankar, the Lord of Snows, has been provided on excellent native authority, confirmed by that competent Tibetan scholar, Major (now Colonel) Waddell, and I trust this name may in the future be used for the highest mountain in the world. The point at issue is mainly one of taste. Indian surveyors may see no incongruity in naming after one

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* See 'Report on the Identification and Nomenclature of the Himalayan Peaks as seen from Katmandu, Nepal.' By Captain H. Wood, R.E., with Preface by Colonel St. G. Gore, C.S.I., R.E. Calcutta: 1904. 3s.

of their own late chiefs the highest mountain in the world. But in this view they are, I believe, in a small minority.*

I would urge mountain explorers to attempt in more distant lands what the late Messrs. Adams-Reilly and Nichols, Mr. Tuckett, and Lieut. Payer (of Arctic fame) did forty years ago with so much success in the Alps, what the Swiss Alpine Club have done lately—take a district, and working from the trigonometrically fixed points of a survey, where one exists, fill it in by planetabling with the help of the instruments for photographic and telephotographic surveying, in the use of which Mr. Reeves, the map curator to the R.G.S., is happy to give instruction. An excellent piece of work of this kind has been done by Mr. Stein in Central Asia.

There are, I know, some old-fashioned persons in this country who dispute the use of photography in mountain work. It can only be because they have never given it a full and fair trial with proper instruments.

Lastly, I come to a matter on which we may hope before long to have the advantage of medical opinion, based for the first time on a large number of cases. I refer to the effects of high altitudes on the human frame and the extent of the normal diminution in force as men ascend. The advance to Lhasa ought to do much to throw light on this interesting subject. I trust the Indian Government has taken care that the subject shall be carefully investigated by experts. The experience of most mountaineers (including my own) in the last few years has tended to modify our previous belief that bodily weakness increases more or less regularly with increasing altitude. Mr. White, the Resident in Sikhim, and my party both found on the borders of Tibet that the feelings of fatigue and discomfort that manifested themselves at about 14,000 to 16,000 feet tended to diminish as we climbed to 20,000 or 21,000 feet. I shall always regret that when I was travelling in 1899 on the shoulders of Kangchenjunga the exceptional snowfall altogether prevented me from testing the point at which any of our ascents were stopped by discomforts due to the atmosphere. Owing to the nature of the footing, soft snow lying on hard, it was more difficult to walk uphill than on a shingly beach; and it was impossible for us to discriminate between the causes of exhaustion.

Here I must bring this, I fear, desultory address to an end. I might easily have made it more purely geographical, if it is geography to furnish a mass of statistics that are better and more intelligibly given by a map. I might have dwelt on my own explorations in greater detail, or have summarized those of my friends of the Alpine Club. But I have done all this elsewhere in books or reviews, and I was unwilling to inflict it for a second time on any of my hearers who may have done me the honour to read what I have written. Looking back, I find I have been able to communicate very little of value, yet I trust I may have suggested to some of my audience what opportunities mountains offer for scientific observations to mountaineers better qualified in science than the present speaker, and how far we scouts or pioneers are from having exhausted even our Alpine playground as a field for intelligent and systematic research.

And even if the value to others of his travels may be doubtful, the Alpine explorer is sure of his reward. What has been said of books is true also of mountains—they are the best of friends. Poets and geologists may proclaim—

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* See, for more recent discussions of this question in periodicals, *Proceedings of the Royal Geographical Society*, N.S., 1885, vii., 753; 1886, viii., 88, 176, 257; 1891, xiii., 108; *Geographical Journal*, 1903, xxi., 294; 1904, xxiii., 89; xxiv., 356; *Alpine Journal*, 1886, xii., 438; 1902–3, xxi., 33, 317; 1904, xxii., 56; *Petermanns Mitteilungen*, 1888, xxxiv., 338; 1890, xxxvi., 251; 1901, xlvii., 40, 289; 1902, xlviii., 14.

"The hills are shadows, and they flow
From form to form, and nothing stands."

But for us creatures of a day the great mountains stand fast, the Jungfrau and Mont Blanc do not change. Through all the vicissitudes of life we find them sure and sympathetic companions. Let me conclude with two lines which I found engraved on a tomb in Santa Croce at Florence—

"Huc properate, viri, salebrosum scandite montem,
Pulchra laboris erunt præmia, palma, quies."

GEOGRAPHY AT THE BRITISH ASSOCIATION, CAMBRIDGE MEETING.

WHILE the Geographical section was not thrilled by stirring adventure or revolutionary theory, the papers were all of considerable interest; but the purely scientific side of geographical work was less prominent than in some recent meetings. The admirable presidential address on Mountains and Mankind with which Mr. Freshfield opened the proceedings will be found on the previous pages. Of the papers about little or unknown parts of the Earth, Mr. Bruce's account of the excellent work done by the Scottish National Antarctic Expedition, and Major Burdon's sympathetic and illuminating description of the Fulani Emirates of Northern Nigeria, were the most important.

The papers may be divided into those dealing with (*a*) England and Wales, (*b*) the Mediterranean basin, (*c*) British lands beyond the seas, (*d*) other travel papers, (*e*) glacier and high mountain areas, (*f*) surveying and cartography.

(*a*) *England and Wales.*—Dr. Mill showed the map of England and Wales with the names of the physical features which Mr. Chisholm, Mr. Mackinder, and he ultimately agreed upon, and which have been adopted by the Royal Geographical Society. This map will be of great service, more especially after a few modifications are made which the inquiry into the usages of various localities and the detailed study of different natural regions will undoubtedly suggest. Mr. Whitaker pointed out one or two of these at the meeting.

Mr. Yule Oldham showed how the conditions of the Fen district had been altered by the cutting of the old and new Bedford rivers, and the construction of the great Denver sluice. This diverted the tide up the new channel, whereas formerly it passed up the Ouse almost to Cambridge, and in the unregulated days was largely responsible for the marshiness of the Fens, which have been drained since this was altered. The old river-course is indicated by the county boundary between Cambridgeshire and Norfolk. Fen vegetation in the present drained area, but more particularly in the few remaining undrained patches, was treated in a paper clearly illustrated by beautiful slides by Mr. R. H. Yapp. The Rev. Alfred Hunt identified the site of the battle of Brunanburh, where Athelstan conquered Anlaff and Constantine, and secured the supremacy of Southern England, with Burnham in north Lincolnshire, four miles south of Barrow Haven. As earthworks of Danish form exist at Barrow Haven, it may have been Anlaff's landing-place.

(*b*) *The Mediterranean Basin.*—Mr. Günther's paper, dealing with changes of sea-level, due to oscillation of the land, has already been published in the *Journal* (August and September, 1903). He cited some new evidence from Genoa, which was supplemented by Mr. R. D. Oldham, for the south of France. Mr. J. Y. Buchanan instanced caves above sea-level, near Monaco, one of which has recently been explored by the liberality of the Prince of Monaco, but he thought that Mr.

Günther should not reject absolutely all considerations of changes in volume of the Mediterranean waters. Mr. D. G. Hogarth's paper on Cyrenaica also contained evidence of changes in the coast-line since classical times, and showed how much a keen observer could make of a short visit of less than a week to a spot of so great historical significance. Dr. Tempest Anderson has recently continued his volcanic studies at the Lipari Islands, and he showed a very beautiful set of lantern slides, which he explained. This was one of the special afternoon lectures, which were this year substituted in this and some other sections for more technical papers. The other was given by Mr. Silva White, on scenes and studies in the Nile valley, and was full of admirably expressed descriptions, both of the valley itself and of the surrounding desert. The word painting of the desert scenes was especially vivid and impressed all who heard it.

(*c*) *British Lands.*—The account of the Fulani Emirates of Northern Nigeria by the Resident of Sokoto, Major J. A. Burdon, will appear in full in the *Journal.*

Mr. Lepper's notes on the Malabar coast of India dealt with all aspects of the geography of the 30 to 60 miles wide coast strip between 8° and 16° N. In describing the physical features, the author dwelt especially on the remarkable system of rivers, lagoons, and canals which stretch throughout Travancore, Cochin, and the Malabar district for about 200 miles. These inland waters did much to facilitate communication on a coast on which marine navigation was practically suspended during the south-west monsoon, the breaking of which was vividly described. The value of the vegetable products was insisted on, and a sketch given of the puzzling ethnological conditions of the country. The population was described as essentially Dravidian, modified by Aryan (Brahman) settlers, through the prevalence of the matriarchal family system. The style of architecture was quite distinct from any other style in India. In conclusion, the author pointed out the astonishing progress which had been made in the Malabar Coast States during the last fifty years, and insisted on the need of firm but tactful and sympathetic treatment of old institutions, of efficiency, honesty, and continuity in administration.

(*d*) *Other Travel Papers.*—Mr. Arthur W. Hill described a journey round Lake Titicaca made during the spring of 1903, which is the rainy season on the plateau. From La Paz, the capital of Bolivia, the route lay along the southern shore of the lake to Tiahuanaco, where there exist some of the finest and most ancient stone monuments in South America; thence to the Desaguadero, the only stream flowing out of the lake, and across this, going eastward to Copacabana. Here some stay was made, and the sacred island of Titicaca, with its Inca temples and palaces, was visited. The ancient terraced hillsides were still cultivated with barley, potatoes, quinoa (*Chenopodium*), ocas (*Oxalis*), and beans; wheat and maize could only be grown in sheltered spots at this elevation. The narrow straits of Tiquina were crossed and the journey continued along the north-eastern shore of the lake, with digressions into the eastern mountains, and plants were collected up to about 16,500 feet. The majority of the plants showed a striking uniformity as regards their vegetative habit, they grow usually in rosettes or mounds, had long tap roots, which enabled them to absorb water from the warmer soil at a considerable distance below the surface, and their leaves were usually linear and often hairy. These peculiarities were induced by the climatic conditions, since the plants had to endure a burning sun during the day, followed by frost at night, with cold, cutting winds; there being often a difference in temperature of as much as 70° Fahr. in a few hours. The journey was continued round the northern end of the lake, where the Indian huts are built of mud bricks in the shape of beehives, and was terminated at the Peruvian port of Puno, whence runs the railway to Arequipa and Mollendo.

Mr. W. S. Bruce had a crowded audience to listen to his account of the Scottish

Antarctic Expedition. The skilful way in which the leader and his captain had successfully carried out the work planned, the decision not to winter in the ice, and the absence of any sledge-work on the land were no doubt largely responsible for the absence of thrilling tales of adventure which are usually associated with polar exploration. An outline of the course of the expedition has already appeared in the *Journal*, and of course it will be months if not years before the oceanographical, meteorological, magnetic, biological, and other data are discussed, and the contribution of the expedition to our knowledge of the Antarctic regions properly estimated.

(*e*) *Glacier and High Mountain Areas.*—It was fitting, with Mr. Freshfield as president, that particular attention should be paid to geographical work done by mountaineers. Mr. Maurice de Déchy's communication on the glaciers of the Caucasus will be published in the *Journal*.

Mr. Charles Rabot's account of glacier-bursts, which have in many cases greatly modified the topography within a valley, will also appear in the *Journal*.

Mr. A. W. Andrews' address on the Passes of the Alps was drawn up from the educational point of view, as a geographical object-lesson. He put together in the form of lantern-slides a series of physical and political maps of the Alps and their main sub-divisions, river basins, railways, passes, etc., with beautiful views of typical scenery, which gave some idea to those who had not travelled of the geographical conditions that prevailed in such a region. This was only one of a series of geographical object-lessons he was preparing.

(*f*) *Surveying and Cartography.*—Major Close communicated an outline of methods of topographical surveying, a subject on which he will, we hope, develop his views at a future meeting of the research department of the Society. Mr. C. R. Beazley dealt with the first true maps, and discussed the origin and authors of the portolani of the early fourteenth century. The Rev. H. S. Cronin outlined the way in which he conceived Ptolemy constructed his map of Asia Minor, in a paper which will shortly appear in the *Journal*.

Committees.—The Terrestrial Wave Committee Report, drawn up by Dr. Vaughan Cornish, gave a photograph and description of a roll-wave which moves downstream faster than the current—a form sometimes found in the Tees. The committee asked, and was to be, reappointed.

A committee was appointed without a grant to carry out an investigation into the changes of sea-level in the Mediterranean basin.

A committee, recommended by the Geological and Geographical sections, was appointed without a grant to collect information about the exact meaning and extension of local terms applied to different geographical and geological forms. Information should be sent to the secretary, Mr. Fearnsides.

A committee, recommended by the Geographical and Zoological sections, was appointed with a grant of £150 for the investigation of the geographical and biological conditions of the Indian ocean. Mr. J. Stanley Gardiner is secretary, and proposes to conduct a new expedition to those waters at an early date.

Papers of Special Geographical Interest in other Sections.—Dr. J. E. Marr, who was one of the editors of the excellent 'Natural History of Cambridgeshire,' supplied to members, gave an address on the geology, and Mr. Whitaker read a paper on the wells of the county in Section C. Mr. Harmer's communication on the Great Eastern glacier, and Mr. Spiller's on the erosion of the Suffolk coast—Dunwich to Covehithe—were other papers of local geographical interest. The river capture of the Don system has been traced by the Rev. W. Lower Carter, and an abstract of his paper will appear in the *Journal*. The interesting discussion on the nature and origin of Earth movements in the Geological section led to no very definite

conclusions on this vexed difficult subject. Mr. J. A. Hutton's paper on "Cotton-growing in the Empire" was of geographical as well as economic importance, for the geographical aspect is of fundamental importance in the problem of the extension of the cotton-producing area. Mr. J. A. Baines discussed the distribution of rural population in India, in Section F. The proposed barrage of the Thames, on which Mr. J. Casey spoke to the engineers, will probably have physical geographical as well as economic geographical results, if it is built. Sir Richard Temple's plan for a uniform scientific record of the languages of savages should interest all travellers; Mr. Edgar Thurston's account of the ethnographic survey of Madras all historical geographers; and Mr. Edmond Demolins' social classification those who study problems of social geography. These were communicated to Section H. In the Botanical section the stimulus which came in part from the geographers towards the study of ecological problems is producing excellent results, as the papers by Prof. Tansley, Dr. W. G. Smith, and Messrs. Lewis and Woolhead show. This section was fortunate enough to have a paper by Prof. Engler, of Berlin, on "Plants of the North Temperate Zone in their transition to the high mountains of tropical Africa."

The most important communication outside the Geographical section which had a geographical interest was probably the address given by Sir John Eliot, as President of the sub-section of Astronomy and Cosmical Physics, in which he dealt with the climatology of India—an address too full of important points to be summarized in the present report.

A NEW MAP OF TRANSBAIKALIA.

By Prince P. KROPOTKIN.

The just-published twenty-fifth part of the 'Geological and Mining Explorations along the Line of the Siberian Railway' (St. Petersburg, 1904, 4to, pp. 46), which is edited by the Russian Geological Committee, contains a new map of Southern Transbaikalia, in two and a half sheets, on the scale of 1 : 840,000, *i.e.* 13⅓ miles to the inch. The map has been made, under the supervision of Prof. V. A. Obrucheff and his assistants, A. P. Gerasimoff and Prince Hedroitz, by Y. M. Barannikoff; the General Staff of Eastern Siberia and the Mining Administration, as also the head of the Baikal Hydrographical Survey, graciously supplying all the surveys and cartographic materials which they had in their possession. An explanatory text, containing the list of all the spots for which there were astronomical observations of latitudes and longitudes, as also a map showing the character of the different surveys which were available for the different portions of the region, are given by A. P. Gerasimoff with his text.

A mere glance at the map shows how much it is in advance of all previous work of the kind. The material has been most conscientiously and ably utilized, and for most of the region the river-network may be taken as quite reliable. There are, of course, large spaces, even in Southern Transbaikalia, which remain still imperfectly mapped, and are very poorly known as regards their orography; but immense progress is already realized by this new map.

Great attention has also been paid to the orography of the region. "As regards the situation and the directions of the mountain ranges," M. Gerasimoff writes, "the present map widely differs from the maps which are now in circulation, because under the name of ranges we did not understand disorderly running water-partings traced between the rivers, but such upheavals as are in strict causal

dependence upon the general geological structure of the country and the direction of the tectonic lines, which are very often decisive in the determination of the present forms of the relief of Transbaikalia. In most cases those water-partings which, owing to their relative or their absolute altitudes, or to some other characteristic features, have received separate names from the local population, are nothing but portions, or even spurs of the tectonic ranges. Consequently, it was necessary to trace a number of ranges which do not exist on previous maps. To such orographic units new names were given (Cherski's, Erman's, Argunski range, etc.), or local names were extended to them (Zaganski, Tsagandaban, Borshovochnyi, etc.).

"If we consider the directions of the ranges of mountains, the now-published map will here also, in some of its portions, stand in distinct contradiction with existing representations. To give one instance, and not to encumber this sketch with too many such instances, I shall only point to the Yablonovoi Khrebet, which is usually represented as a water-parting between the tributaries of the Arctic and the Pacific ocean, and consequently is traced along the water-parting between the Ingoda and the Chikoi, the Ingoda and the Khilok, the Chita and the Konda; and between the basins of the Ingoda and Shilka on the one side, and that of the Lena on the other, although the tectonic lines which have determined its differentiation have quite another direction, and only for a short distance coincide with the Yablonovoi range of the old maps. What we call the Yablonovoi range is the water-parting between the Chikoi and the Khilok (the Malkhanski range), the Khilok and the Ingoda, the Chita and the Konda, the Karenga and the Vitim; it runs further on in a north-eastern direction into still unexplored regions. Another instance is the Adun-chalon, which is usually drawn as a long range running east-north-east; in reality it is a quite small massif, surrounded on all sides by wide lowlands" [high plains?—that is, plains of about 2000 feet in altitude—P. K.].

These few lines already give an idea of the importance of the new map. I will only permit myself one remark. I am delighted, of course, to see that the ideas which I expressed thirty years ago concerning the Yablonovoi range being continued in a due north-eastern direction, from the spot where it is crossed by the high-road to Chita, and not going to join the imaginary Stanovoi range,* are confirmed now by such high authorities as Gerasimoff and Obrucheff, of whom the latter has not only perfectly well studied all the previous explorations of Transbaikalia, but has also personally visited that portion of the Vitim and the Karenga. But I may be permitted to ask whether the map is right in considering the Malkhanski range, between the Khilok and the Chikoi, as a continuation of the Yablonovoi? This last, between the upper Khilok and the Ingoda, where we know it best, represents quite distinctly the south-eastern border-range of the upper terrace of the plateau. Now, my idea was, and is still even more than before, that a border-range having the same orographic character is continued south-westwards, through the Sokhondo, between the sources of the Menzia, right-bank tributary of the Chikoi, and the Balja, left-bank affluent of the Onon (cf. altitudes of Fuss), to the Kentei and the Burulyn-daba, to the south-east of Urga, where we again find an escarpment, quite homological with the one which we cross on approaching the town of Chita from the west. If this supposition be correct, then

* See The Orography of Asia, in *Geographical Journal*, February, 1904, pp. 197-199, and with more detail in 'Orographie de la Sibérie, précédée d'une introduction et d'un aperçu sur l'orographie de l'Asie,' published by the Geographical Institute of Brussels, 1904, pp. 77-86.

all the upper course of the Chikoi, from its sources to its bend at the mouth of the Jerghei, must lie *on the upper terrace of the plateau*, and therefore must be 1000 feet higher than the tributaries of the Onon, such as the Kyra river at the Kyrinski post, or the Kirkun river at Kirkunski. On the contrary, if this supposition be incorrect, then there must be no general difference between the altitudes of the region situated between the sources of the Khilok and its middle course (the *upper* terrace, in my view) and the valley of the upper Onon, which, by my supposition, flows on the *lower* terrace of the plateau. Further exploration of this region will therefore be most welcome, but we can already say that what we know about it from the altitudes of Fuss seems rather clearly to support the just-expressed view.*

The observations of Fuss reveal the existence of an escarpment, homological, on the one side, with the Kentei escarpment, and on the other with the Yablonovoi escarpment which faces the town of Chita. Is this merely an accidental homology, which surely must be shown on a map, but has no geological reason; or have we not here one more instance of the fact indicated by Gerasimoff in the above quotation—namely, that the orography of Transbaikalia is closely connected with the tectonic features?

Another remark which I will venture to make concerns the lower course of both the Argun and the Shilka. This part of the map is not yet finished, and the corresponding half-sheet seems to be but a temporary sketch; but we see on it, in long. 122° E., the inscription, placed in a direction from north-west to south-east, "Great Khingan Range." It is for the first time that the Great Khingan is placed in this position and in this portion of the territory, and no doubt the compilers of the map must have had some reasons for giving this quite new position to the great range. That there may be a range running north-west to south-east, and crossing the Argun and the Shilka, we certainly shall have no reason to question, if the geologists who have explored Transbaikalia do come to such a conclusion; but that this range should be *a continuation of the Great Khingan, i.e.* of the border range of the lower terrace of the plateau, which we know perfectly well from Kalgan to the sources of the Gan, where I crossed it in 1864, seems now to be extremely doubtful, not to say quite impossible. In order to admit that the eastern border-range of the upper terrace of the plateau makes this bend, we should require to find to the north-east of this new Khingan the lower Manchurian terrace of the plateau, while we know perfectly well from Usoltseff and Orloff that on the Oldoi we have a continuation of the *upper terrace of the plateau, i.e.* marshy plains over 3000 feet high. At any rate, in order to give such a new position to the Great Khingan, we ought to have at least some surveys between the upper

* This is how I summed up the observations of Fuss: "The series of altitudes determined by Fuss gives a very neat idea of this escarpment. Leaving aside the observations made at the bottom of the valley of the Chikoi, which is pretty deeply sunk in the plateau, after having run a long course over its surface, we see that at the sources of the Katantsa the plateau reaches altitudes of 2900 feet; further on, the road, which goes eastwards, attains the altitude of 3500 feet, as it follows the Menzia; then it reaches the height of the pass across the Yablonovoi, and descends into a longitudinal valley; further on it crosses a range of mountains which runs parallel to the above escarpment, and reaches a height of 4500 feet—similarly to the range which runs on the left bank of the Chita and the right bank of the Ingoda [Gerasimoff has named it the Cherski range]; and, finally, the road issues on the lower, steppe-terrace of the plateau, where altitudes of 3000 feet are met no more on its surface, but where we find a steppe of from 2000 to 2500 feet of average altitude" ("General Sketch of the Orography of Eastern Siberia," in *Zapiski* (Memoirs) of Russian Geogr. Soc., 1875, vol. v. p. 48; 'Orographie de la Sibérie,' Brussels, 1904, p. 79).

Gan, where I crossed it (the most northern place where the Great Khingan has hitherto been crossed), and the place where we find the Great Khingan now on the map of Transbaikalia. Have such surveys been made? Or, is this simply a new local name which lately began to be given to these mountains (it did not exist in 1865, when I crossed this region), just as since the last Boxer war the name of "Little Khingan" has been given to the mountains which were formerly known as the Ilkhuri-alin? As this part of Gerasimoff's map of Transbaikalia is only provisional (the mountains are not yet traced on it, and the above inscription stands on a white space), we are sure that MM. Gerasimoff and Obrucheff will take these remarks of a fellow-worker in good part, and perhaps, by insisting upon the necessity of sending an expedition to the northern parts of the Great Khingan, will settle at last the exact position of this extremely important landmark.

THE ANNUAL RAINFALL OF THE BRITISH ISLES.*

Dr. Mill has made another valuable contribution to the geography of the British Isles in this new paper. The rainfall of our islands has been discussed by Dr. Buchan and the late Mr. Symons among others, and recently Dr. Buchan prepared new maps for the months and the year based on twenty-five years' means, which were published in Bartholomew's 'Atlas of Meteorology.' Dr. Mill's data are not merely for a longer period, but they are discussed and mapped in much greater detail than has been done in previous papers on our rainfall.

Dr. Mill takes up, first of all, the question of the length of time rainfall observations must have been taken before means of sufficient stability are obtained to make the tables and the maps based on them thoroughly satisfactory representations of this element of climate. Dr. Hann has recently shown for Padua, Klagenfurt, and Milan that a thirty years' mean differs only about 2·6 per cent. from one three to six times as long, and a forty years' mean still varies 2·3 per cent., but a twenty years' mean differs 5·2 per cent. from the longer one. Dr. Mill finds that, for five British stations, the successive means for the thirty years beginning 1830, 1840, 1850, 1860, and 1870 are 98·6, 98·4, 100·3, 103·1, and 101·3 per cent. of the 70 years' mean. Hence the thirty years' mean 1870–99 may be taken to give a very close approximation to the true mean, and this he adopts as the basis of his work.

It is unnecessary to detail the checks applied to the returns to ensure their accuracy; suffice it to say that Dr. Mill has presented in tabular and cartographic form the most reliable and complete account of the rainfall of the British Isles yet published. The maps, as is proper in such a work as this, show only such results as can be deduced from the figures themselves, and it lies with the geographer, should he require it, to construct a map which will take into account the variations introduced by configuration and exposure. As it is, Dr. Mill's maps can be interpreted largely by configuration and wind maps without any question of personal bias entering into the estimation of the significance of configuration or air-movements on the distribution of rainfall as shown on the map. His map of annual rainfall agrees in the main with those already published. It is unnecessary to recapitulate the main characteristics of these maps. In many details, however, the new map reveals interesting features not previously shown. Among them may be cited

* "On the Distribution of Mean and Extreme Annual Rainfall over the British Isles," by Hugh Robert Mill, D.Sc., LL.D., with an abstract of the discussion upon the paper. *Minutes of Proc. of Inst. of C.E.*, clv. pp. 3–88.

the areas of greater precipitation over the Weald, the Downs, and the East Anglian Heights, which have never been so clearly brought out before. We need more rain-gauges close together where the elevation rapidly alters, and new and interesting results might be expected even from the districts just mentioned. In the Highlands of Scotland and in parts of Ireland there is a deplorable absence of rainfall observations, where it is most necessary to have many, not merely for scientific interest, but for their practical value in view of the rapidly extending use of water-power as a generator of electricity.*

Dr. Mill points out that the existing figures do not permit the calculation of any generally applicable formula for the relation between the amount of rainfall and height.

The following table summarizes the results of Dr. Mill's calculations as to the areas of different amounts of rainfall, and the average rainfall and volume for the different parts of the British Isles:—

AREA IN SQUARE MILES AND PERCENTAGE OF TOTAL AREA IN RAINFALL ZONES. AVERAGE OF YEARS 1870–99.

	Under 25 inches.		25 to 30 inches.		30 to 40 inches.		40 to 60 inches.		Over 60 inches.	
	Area.	%	Area.	%	Area.	%	Area.	%	Area.	%
England ...	9776	19·5	18,552	37·1	15,333	30·7	5624	11·2	768	1·4
Wales	0	0·0	128	1·7	1856	25·2	3888	52·7	1504	20·4
Scotland ...	224	0·8	2368	8·6	9856	36·0	10,005	36·5	4960	18·1
Ireland ...	0	0·0	704	1·9	13,100	40·1	17,408	53·3	1482	4·6
Isle of Man ...	0	0·0	64	28·5	104	46·5	56	25·0	0	0·0
Total ...	10,000	8·5	21,816	18·5	40,249	34·3	36,981	31·4	8714	7·4

A valuable part of the paper is the discussion of the year of maximum and minimum precipitation, and the amount and the proportion of each to the mean. 1872 was the wettest year in the British Isles, and, as Mr. Tripp has pointed out, one of the wettest years on record for most parts of the world. 1887 was the driest. "Perhaps 1852 was as wet as 1872, and 1864 may have been as dry as 1887; but with these possible exceptions, no other year approached either as an extreme." The table on p. 468 shows the values for the average and extreme years.

The maximum and minimum rainfalls, however, are not synchronous for all parts of the British Isles, and it is not surprising to find that there is a marked climatic contrast between the west and east of Scotland, and, as Dr. Buchan has shown, the maximum on the one side may coincide with the minimum on the other. Mr. Archibald pointed out that eight places in the east of England had their minimum year 1874, and ten in 1898; while for six places in north-west

* Of course such observations should be carried out by Government aid, and it is necessary to point out that a systematic study of this country's resources is one of the most pressing problems for our statesmen to consider. The ridiculous pittance at present available for meteorological purposes is only one of the many advertisements of our existing inefficiency. It is reported the Government even means to permit the closing of the only permanent observing station we possess in the upper air, instead of immediately setting up another in Kerry, as they should do!

Scotland 1874, and for four places 1898, was a maximum year. Dr. Mill points out that the extraordinary relative dryness of the east of England is greatly intensified in wet years. The maps show that the same influences of configuration and prevailing winds are at work in the wettest and driest years as well as in the average, and they also show "how prominent geographical influences really are, and how important it is to be able to understand fully the relationship between rainfall and configuration." These apparent anomalies of wet east with relatively dry west are to be explained by relative increase of rain-bearing easterly winds.

MAXIMUM AND MINIMUM RAINFALL.

	Quantities to nearest half-inch.					Ratios.				
	Average	Max.	1872.	Min.	1887.	Average	Max.	1872.	Min.	1887.
England ...	31·5	46·0	45·0	22·0	23·5	100	146	143	70	74
Wales	49·5	72·5	74·0	37·0	36·5	100	147	149	75	74
Scotland ...	47·0	69·0	62·5	34·0	39·5	100	147	133	72	84
Ireland ...	42·5	56·5	52·0	29·5	32·0	100	133	124	69	76
British Isles	39·5	56·5	53·0	28·0	30·5	100	143	134	71	77

We trust Dr. Mill will continue his investigations, and give us seasonal tables and maps, which will attempt to show the climatic as well as the astronomical seasonal changes, and will be applicable to the study of the climatology of wheat and other crops.

A. J. H.

REVIEWS.

EUROPE.

THE FÆRÖES.

'Botany of the Færöes based upon Danish Investigations.' Copenhagen: det Nordiske Forlag; and London: John Wheldon & Co. Large 8vo. Part i. (1901), pp. 1–338; part ii. (1903), pp. 339–681. *Map. Plates and Figures.*

AFTER some introductory remarks by Warming on the history of botanical investigations in the Færöes, the various conditions—geographical, topographical, geological, meteorological, and industrial—are reviewed by Ostenfeldt in the first volume.

The Færöes are a small group of eighteen islands, with a population numbering 15,000 people, of whom most are descendants of Norsemen, but a few are of Irish descent. Grass is grown for the horses, cattle, and sheep; corn and potatoes for human consumption. The inhabitants also go in for fishing and whaling.

The rocky island scenery is characterized by precipitous and terraced faces, which harbour but few plants. The lower districts are less sloping, and the rocky *débris* found here is covered by grass. The various islands are separated by sounds, which are submerged long valleys, and they are characterized by irregular outlines, owing to the fjords, which represent submerged cirque valleys. Many small streams and lakes are met with.

The rocks belong to the Tertiary formations, and are of igneous origin. Basalt

with layers of tuff intercalated alone occurs in large quantities. Coal is found, and also mined. The action of the Ice age can be clearly made out.

The climate is what we would expect to find in an archipelago. The winter is mild, the summer cold; there is a heavy annual rainfall; storms and fogs are of frequent occurrence.

Of the Phanerogams and Vascular Cryptogams no representatives have been found to be endemic in the Færöes, having all been recorded from the neighbouring countries, seven species only not occurring in Great Britain. Although trees are absent, the flora is of a type characteristic of a woody district in temperate Europe, being most like that met with in Northern Great Britain. Ostenfeldt proves at some length the post-Glacial age of the flora. The plants migrated across a post-Glacial belt of land, and were not brought to the island by birds, wind, or man.

The remaining portion of the first volume is devoted to lists of plants recorded from the Færöes. These are continued in the second volume, which in its turn is concluded by a detailed account of the history of the flora of the Færöes. The third volume will contain a description of the vegetation of the island as an organic whole. O. V. D.

ASIA.

History of Arabian Exploration.

The Penetration of Arabia: A Record of the Development of Western Knowledge concerning the Arabian Peninsula.' By David G. Hogarth. Lawrence & Bullen. 1904. Pp. xvi. + 360. *Illustrations and Maps.*

This second volume of the "Story of Exploration" fully maintains the promise held out by Sir Harry Johnston's 'Nile Quest,' with which the series was opened. Although not himself an Arabian traveller, the established reputation of the author for sound scholarship, and especially for an extensive knowledge of the history, geography, and archæology of the Near Eastern lands generally, was sufficient guarantee that he would give us a valuable book on the progress of geographical research in the Arabian peninsula. A critical study of the rich though not very accessible literature of the subject has enabled him to present a clear and nearly complete picture of exploration in this at once attractive and repellent region from early times down to the present day.

For convenience of treatment, the subject-matter is disposed in two main divisions, the first dealing with "The Pioneers," the second with their "Successors," the whole concluding with a lucid and very welcome summary of the salient physical features of the land. In the introductory chapter, "Before Exploration," there is also a good deal of geographical detail, and here occurs the statement that, "despite Ptolemy, Arabia has not, and probably never had, a true river in all its immense area." This, no doubt, is practically true for the historic period which, in the light of the recently discovered Himyaritic inscriptions, must now be set back to at least the third millennium B.C. But it is difficult to believe that in more remote times the Wady er-Rumma and the other now nearly dried-up arteries were not great perennial watercourses like the corresponding Igharghar, Masarawa, and many others in the Sahara.

But, if here criticized, Ptolemy is elsewhere amply vindicated from the aspersions of Bunbury, who charged him with filling empty spaces with fictitious names "assigned with a vain parade of science to imaginary situations." Many of these names have since been identified, and *Thaim*, the *Tema* of Job, is now known from Assyrian documents to have had a very real existence in Minæan times (A. Jeremias, 'Das Alte Testament' (1904), p. 232).

Conspicuous amongst the later "Pioneers" is the name of Carsten Niebuhr, whose signal services, both as an explorer and archæologist, receive the fullest recognition. As is here pointed out, the primacy always conceded to the Danish traveller is not due to his priority in time, for he was preceded by others (Varthema, Hamilton, Barbier); nor to the extent of his surveys, which were confined to a very narrow corner of the peninsula; but entirely "to the priority of his merit." So accurate are his descriptions, that Playfair is quoted as stating that, after a lapse of over a century, "we have never since been given a clearer or more interesting and valuable account of Yemen." This term *Yemen* is usually taken as synonymous with Pliny's *Arabia Felix*, which is wrongly restricted to south-west Arabia. "*Felix* was really applied by the ancients to the whole of the peninsula. *Petræa* was only the district of Petra, and *Deserta* the North Hamad or 'Syrian Desert'" (p. 41). It is, however, to be noted that if, instead of *yemen* = south, we are to read *yaman* = happy, this expression would then appear to be equivalent to *Arabia Felix* in its more restricted sense, and the general aspect of the country certainly lends colour to this now current use of the term.

In the pioneer section the scene shifts from Yemen to the northern territory of Hejaz and Nejd, then to the south-west and south, and so back to the "unknown north." Here the reader will be able to follow the steady progress of the first rough surveys of the greater part of the interior and coast lands in company with such skilful guides as the erudite Burckhardt, the keen-eyed Seetzen, the accurate Wellsted and Wallin, and the ubiquitous Burton. All receive ample justice at the hands of our most conscientious author, who carefully traces their often intricate itineraries with unwearied patience. The monotony of this necessary work is continuously relieved by graphic accounts of Wahhabis and Shommars, of desert life, and of renegades and adventures, such as Keith, the Scot, governor of the Holy City of Medina in 1815, Atkins the Englishman, and the Italian Finati, both careering up and down the peninsula during the Egyptian campaigns.

The rest of the volume, about one-half, is given up to the "Successors" of the pioneers, "the second generation of Arabian explorers," whose operations begin with the middle of the nineteenth century, and are still far from concluded.

Here the regions revisited and more fully explored are the western, southern, and eastern borderland, the central north, the centre, and the central south, all in the order named. Amongst the names which now begin to crowd the author's pages, the more prominent are J. Halévy, Glaser, Bent, Manzoni, Palgrave, Pelly, Huber, Euting, and the never-to-be-forgotten C. M. Doughty. All receive due recognition with the rather important exception of the late Theodore Bent, whose fruitful researches amid the extensive ruins that I have been able to identify as those of the Biblical Ophir have been strangely overlooked.

The publishers deserve all praise for the way they have turned out this handsome volume, with its stout paper, bold type, copious index, plans, maps, ancient and modern, and excellently reproduced portraits of Niebuhr, Burton, Seetzen, Burckhardt, Halevy, Palgrave, Doughty, and some other Arabian worthies.

A. H. Keane.

AFRICA.

Major Gibbons on his African Journeys.

'Africa from South to North through Marotseland.' By Major A. St. H. Gibbons. 2 vols. London and New York: John Lane. 1904.

For the extent of his routes through unknown or imperfectly known African countries, Major Gibbons stands well in the front rank of recent travellers in that continent. While from some points of view his journey of 1898–1900 may be

considered as among the last of the great pioneer journeys, it belongs also to the new order of things in regard to the detailed character of the work accomplished in its special field of activity—the Zambezi basin. The full narrative of the events of the expedition, which has now appeared after an interval of some five years since its author's return, could not fail therefore to supply material of the first importance to the student of African geography and ethnology, and this expectation is in no way disappointed on a closer examination of the volumes.

The general outline of Major Gibbons's work is well-known to readers of the *Journal* through the paper read before the Society after his return from Africa, and it is needless to enlarge upon it here. The subject-matter of the book may be divided into three main sections, the first dealing with the examination of the middle and lower course of the Zambezi—the first ever undertaken with sufficient thoroughness to give an accurate idea of the possibilities of navigation on the great river; the second describing the journeys by various members of the party, which threw a network of routes over the whole extent of the Marotse empire; and the third embracing the homeward route across the Congo basin to the Nile. The first two of these sections form, perhaps, the most solid and valuable part of the book, which, it can hardly be questioned, is the most important contribution to our knowledge of the Zambezi basin which has appeared since Livingstone's time. The memories of the great explorer which it calls up from time to time will give it an added interest to many readers.

In the first section the attention of the reader is naturally focussed on the gallant efforts put forth by the explorers in their struggle with the furious current of the Zambezi during its passage through the gorges which characterize its middle course, the sombre impressiveness of which is vividly depicted by the author. It was only by almost superhuman efforts that the *Constance* was successfully brought through some of these, and that disaster was avoided speaks well for the qualities of the vessel, constructed on the Hodgetts principle. The state of the river when the ascent was made rendered the test of its navigability a particularly severe one, and in spite of the difficulties encountered, Major Gibbons considers the result to be on the whole distinctly favourable to the use of the middle and lower sections of the river as a waterway.

The second and largest section of the book supplies, incidentally, many details regarding the physical character of the upper Zambezi region, both on the east and west of the main stream. On p. 116 (vol. i.), the author sketches the general aspect of this upper basin of the river, which is marked above all by its white sandy soil, rising between the rivers into a succession of undulations. On the Okavango, on the other hand, a yellow soil prevails, and with it a vegetation marked by thorny acacias. The information as to the course and character of this river—hitherto inaccurately placed on our maps—is of much value. Further north, Major Gibbons entered the area of the dwarf *Landolphia* (*L. florida*), which forms the basis of the rubber industry of this part of Africa. In this region too he met with a yew-like tree, which took a prominent place in the vegetation, though not seen at all further east. But perhaps the most interesting chapters are those dealing with the Marotse and their history, and their relation to their king, Lewanika, of whose qualities as a man and ruler the author entertains a high opinion. He points out the unmistakable distinction existing between these people and the rest of the natives of South Africa, and hints at a possible connection between them and the dwellers around the northern lakes. Information is also given as regards the various other tribes included under Lewanika's far-reaching sway. The Marotse state differs from the ordinary Negro kingdom in possessing a recognized constitution, while the royal family and upper classes have shown an adaptability

to civilized ideas which the author ascribes to "the elements of refinement and self-respect which exists even in a barbarian aristocracy."

The final section of the journey was noteworthy, as leading to the ultimate source of the Zambezi, which Major Gibbons was the first to describe. The further route along the Zambezi-Congo water-parting would have been of even more importance but for the fact that the Belgian expedition under Capt. Lemaire had simultaneously chosen this line of country as a field of work. The part of the journey carried out in company with Capt. Lemaire gave, however, a useful opportunity of checking the results of the survey, and Major Gibbons dwells with pardonable satisfaction on the close agreement of his work, done with the humble and often-criticized sextant, with that accomplished by the more elaborate methods of the Belgian officer. Another direction in which his ideas met with full justification, was that of the proper conduct of an exploring expedition in its relation to the natives, his experiences supplying yet another proof of the ease with which an unarmed expedition can, as a rule, make its way among new tribes, and the demoralization often caused by the use of armed askaris. Major Gibbons enters somewhat fully into the question of the height of the Ruwenzori range, which, like Sir H. Johnston, he thinks must reach 20,000 feet.

Major Gibbons shows himself throughout a careful observer, anxious to understand the peoples with whom he is brought in contact, and capable of giving the results of his observations in generalized form. The high ideals which he set before him as to the part to be played by white men in their contact with the black race, enabled him to fully sustain the high reputation enjoyed by British travellers in the past, and his remarks, both in the body of the work and in the appendices, on the missionary question, the mental and moral qualities of the Negro, and the right methods of raising him in the scale of civilization, merit careful attention.

The work is illustrated by excellent maps prepared by the author himself, that of the middle and upper Zambezi basin, on a somewhat larger scale than Mr. Ravenstein's map in the *Journal* for February, 1901, being the most valuable.

AMERICA.

Dutch Guiana.

'Gegevens over Land en Volk van Suriname.' Door C. Van Coll, Missionaris in West-Indië. (Bijdragen tot de Taal-, Land-, en Volkenkunde van Nederlandsch-Indië. Deel i. Afl. 4.)

These notices appeared a few years ago in the supplements to the newspaper *De Suriname*, and are now reprinted in an enlarged and amended form. Pater van Coll has availed himself of the works of Kappler, Crevaux, Im Thurn, and other authors, to whom he acknowledges his indebtedness, but having passed more than thirty years of his life as a missionary in Dutch Guiana, he has collected much information himself on the manners and customs of the coloured inhabitants. In the first part of his work he describes the aboriginal tribes—the Caribs, Arrowaks, and Waraus. After a short sketch of their history and their relations with the white settlers, he passes on to their villages, clothing, food, and utensils, their feasts and marriage customs, their religious beliefs and myths. The second part contains an equally full account of the Bush Negroes, the difficulties they had to contend with in supporting life in the forest after they had run away from their white masters, and their superstitions. A rich store of facts is collected in these pages which the ethnologist will find useful. The author himself makes little attempt to discriminate between what is of purely native origin and what has been learned from Europeans. For instance, some of the legends he retails as of Indian origin

seem to have a decided European tinge. The third part of the work is of less value, being almost entirely a compilation, in which, moreover, the works of recent travellers have not been utilized; it deals with the whole Guiana country and the surrounding peoples.

The Missionary in the Chaco.

'Among the Indians of the Paraguayan Chaco.' Edited by Getrude Wilson, B. LITT. C. Murray & Co., and South American Missionary Society. 1904. Pp. xiv., 176. With a Map.

Mr. W. Barbrooke Grubb and his fellow-workers in the Chaco Mission have provided material for this excellent account of the Indians of that little-known region about the Tropic of Capricorn and west of the river Paraguay. The account, it is true, is merely incidental to the history of the mission up to the present day; but it is well illustrated with many photographs and an engraving. The missionaries do not appear to have any inclination towards topographical description; if they had, the map inserted in the volume could hardly have passed. This shows a large area of central South America, which has no bearing on the subject, except as including the small particular area covered by the mission; and there is a large-scale inset of that particular area. The two representations of the mission area are hardly recognizable as the same country. It is well to be able to record that the Chaco missionaries, aided from without by their successive superintendents, Bishops Stirling and Every, of the Falkland islands, have met with deserved success in their difficult task.

O. J. R. H.

ANTHROPOGEOGRAPHY AND HISTORICAL GEOGRAPHY.

Primitive Trade.

'The Silent Trade: A Contribution to the Early History of Human Intercourse.' By P. J. Hamilton Grierson. Edinburgh: Green & Sons. 1903. Pp. x. + 112.

By the "Silent Trade," Mr. Grierson means what the Germans call the "Stummer Handel," that kind of barter that sprang up between primitive peoples before they were, so to say, on speaking terms with each other, while, in fact, the normal attitude was still one of mutual distrust and hostility. References to the subject are very numerous, and range over the whole of literature from classic times (Herodotus, Pliny) down to the last book of modern travel. But they are for the most part of a casual or incidental nature, and Mr. Grierson may rightly claim that in this little volume, a veritable *multum in parvo*, the traffic has for the first time been subjected to systematic treatment. He has not only shown great learning and diligence in bringing together a vast number of passages bearing on the practice from almost every available source, but has also formulated a reasonable theory of its origin and evolution, a theory all the more acceptable since it is not deduced from any preconceived notions, but is a legitimate induction from a careful study of many facts vouched for by the most trustworthy observers. As the *homo homini lupus* stage gets worked out, it dawns upon the primitive hunter that the stranger may be more profitable living than dead. He possesses covetable belongings which may be more easily or more safely obtained by peaceful means than by open violence; and as one good turn deserves another, something tempting is placed within his reach on the tribal borderland, in the hope that it will be accepted as a "gift," which in rude society always expects a *quid pro quo*. If the bait takes, the manœuvre is repeated, the practice spreads, and all the rest follows in natural sequence. Trysting-places become intertribal markets; the clever

interpreter who knows both languages becomes the recognized middleman; and everything gradually receives social and religious sanction. Hence the Greek *Hermes Agoraios*, the Gaulish Mercury, the sacred character of the herald, of the envoy, the ambassador of later times. It is thus seen what an important part the Silent Trade has played in promoting international intercourse, and furthering social progress in all directions.

A. H. K.

AUSTRALASIA AND PACIFIC ISLANDS.

Australian Ethnology.

'The Northern Tribes of Central Australia.' By Baldwin Spencer, M.A., F.R.S., and F. J. Gillen. London: Macmillan & Co. Pp. xxxv., 773. 315 *Figures, Two Illustrations, and a Map.*

Five years ago Prof. Baldwin Spencer and Mr. F. J. Gillen published a very remarkable book, 'The Native Tribes of Central Australia,' that gave new and unexpected information about the aborigines of Central Australia, and the new ethnological problems suggested by their researches led to lively discussions which have not yet subsided. In their recent traverse across Australia, these authors re-studied the tribes they had previously visited in order to check the observations that had been so much discussed, and to extend their investigations to other tribes. This they successfully accomplished, and we now have a reasonably complete account of the native tribes from Lake Eyre to the Gulf of Carpentaria, and the new researches of these indefatigable travellers connect up those of Dr. A. W. Howitt in the south with those of Dr. Walter Roth in the north. They also confirmed and extended the accounts they had previously given, so that what formerly appeared to be anomalous in the ethnology of Australia has been shown to be fairly widely spread, and, indeed, may have been very general. Negative evidence counts for very little in ethnology, as usually that which is most important and most worth learning about is the very information that is most zealously hidden from the stranger.

Messrs. Spencer and Gillen have proved that the magical ceremonies for the increase of totemic animals, which they first discovered among the Arunta, have a wide range, and incidentally they illustrate what a close connection exists between the religion of a people and the physical conditions under which they live.

The time has not yet arrived when it is possible to map out the distribution of certain customs or implements all over the continent of Australia, but this new book gives a considerable number of facts which will go a long way towards this end, and the authors constantly bear distributional problems in view.

This book must be regarded as one of the most important records ever published of a backward people; the accounts of secret sacred ceremonies are given with great detail, in clear language, and illustrated by a large number of most remarkable photographs.

A. C. H.

THE MONTHLY RECORD.

EUROPE.

The Wettest Place in Wales.—In the August number of *Symons's Meteorological Magazine*, Mr. J. R. Gethin-Jones gives the results of measurements of rainfall made by him in the heart of Snowdonia, at a spot which he considers likely to

prove the wettest in the Snowdon range, and consequently in all Wales. His choice of a spot for the setting up a gauge in 1898 was determined by considerations arising from the configuration of the surface, the Cwm Llydaw, in which the spot lies, being bounded by ridges over 3000 feet in average height, and taking the form of a horse-shoe open to the east or the driest quarter. The effect of this configuration is that, in case of all the wettest winds (from S. by W. to N.), the Cwm forms the sheltered focus in which the moisture-laden currents experience the maximum effects of condensation after passing the ridges. Apart from this special point in favour of Cwm Llydaw, the position of Snowdon itself is particularly conducive to excessive rainfall, inasmuch as five separate valleys radiate from its base towards the sea and the wettest points, and along them the lower strata of the air are conveyed under the most favourable conditions for retaining moisture, and then suddenly lifted 3000 feet within a small horizontal distance. The observations at the Glaslyn gauge in this cwm, from September 1, 1898, to December 31, 1901, give an average annual rainfall of 199·92 inches, which would probably be reduced to about 190 inches over a longer period, judging from observed data at neighbouring stations. During 1903, in which, unfortunately, the record is available for seven months only, Mr. Gethin-Jones concludes, from comparison with the fall at other stations, that the total must have been at least 250 inches, which would exceed the highest yet recorded (243·98 inches at the Stye, Cumberland, in 1872). He urges that more accurate observations should be taken regarding the maximum rainfall in Scotland and Ireland, where, he thinks, figures far higher than any yet obtained would be forthcoming. From a consideration of the facts at the Stye and Snowdon, he thinks that in the sheltered corrie north of Ben Nevis a total of over 300 inches ought to be recorded.

The Coasts of Britanny.—Prof. E. de Martonne presents a review and a valuable supplement to Dr. F. Schwind's dissertation on rias and fiord coasts.* Dr. Schwind arrived at the following figures for rias coasts from his measurements of British and French Admiralty charts :—

Coast.	L = Length of coast. Km.	Proportion of Islands. Per cent.	l_1 = exterior contour. Km.	l_2 = interior contour. Km.	$\frac{L}{l_1}$	$\frac{L}{l_2}$	$\frac{1}{2}\left(\frac{L}{l_1}+\frac{L}{l_2}\right)$
Britanny	3475·571	19	517·610	572·850	6·71	6·07	6·39
Galicia	1902·578	20	341·659	339·735	5·56	5·60	5·58
Corsica	667·3	5	214·6	184·9	3·11	3·61	3·36

The Rennes professor properly points out that the Britanny results are vitiated by the inclusion of such islands as Croix and Belle-ile, situated 3 to 6 miles from the coast, and the assumption that all the coasts of Britanny are ria coasts. Using part of Richthofen's original definition, which is based on the relationship of the coastal form to the tectonic feature lines, only the west transverse coast should contain rias; but following Penck, Dr. de Martonne uses the other part of the definition of this form as one for an elongated gradually shallowing and gradually narrowing inlet independent of structure. Obviously such forms are equally

* "Die Riasküsten und ihr Verhältniss zu den Fjordküsten, unter besonderer Berücksichtigung der horizontalen Gliederung" (*Sitzber. Böhm. Ges. d. Wissensch.*, Prag. 1901. Dissertation, Leipzig, 1901). Mr. de Martonne's paper is in the new part of the *Travaux scientifiques de l'Université de Rennes* (vol. ii. pt. iii. 1903).

confined to limited parts of the Breton coast, the heterogeneous nature of which is clear from the following table, where L, l_1, l_2 have the same meanings as above:—

	L Km.	l_1 Km.	l_2 Km.	$\frac{L}{l_1}$	$\frac{L}{l_2}$	$\frac{1}{2}\left(\frac{L}{l_1}+\frac{L}{l_2}\right)$
North coast between Grouin and St. Mathieu	1275·908	257·35	254·35	4·94	5·01	4·97
West Coast between St. Mathieu and Penmarch	478·873	96·50	115·80	4·96	4·14	4·50
South coast between Penmarch and Lorient	508·494	71·00	92·75	7·16	5·47	6·31
South coast between Lorient and Croisic	1151·296	92·51	108·75	12·42	10·29	11·35

Dr. de Martonne analyzes the coast more carefully in relationship to the tectonic characteristics of the land, and arrives at the following divisions:—

I*a*. Pure ria: (1) from Point de Grouin to Cape Fréhel; (2) from Point Plouzec to Point St. Mathieu; (3) from Point of Penmarch to Loctudy.

I*b*. Sub-type of ria found in the bay of St. Brieuc.

I*c*. Sub-type of ria in folded regions at right angles or obliquely inclined to the mean direction of the coast, here termed the anse type. From Point St. Mathieu to Point of Penmarch.

II*a*. Aberrant type of ria in regions folded parallel to the mean direction of the coast (cf. the vallone of Dalmatia). From Concarneau to Fort Louis.

II*b*. Morbihan type, resulting from an elevation of, or deposition round coasts of type II*a*., with lagoons, sand-spits, and sandy soldering of adjacent islands (Quiberon peninsula). (1) From Loctudy to Concarneau; (2) from Port Louis to the Vilaine.

III*a*. The same type more advanced, from the Vilaine to the Loire (type guérandais). Here the islands and peninsulas are eliminated, and the lagoons dried up or almost desiccated (cf. Croisic salt-pans).

III*b*. Marsh type. Flat alluvial coasts of the marshes of Dol, which may be formed by the flooding of form III*a*.

In the north the ria predominates; in the west, the anse; in the south, the Morbihan or Dol types. It is necessary in all coastal studies to do more than measure; the first procedure should be to examine the structure of the land in its coastal margin.

Scientific Study of the Lake of Bolsena, Italy.—Some three years ago the Italian Geographical Society decided to undertake a thorough investigation of one of the Italian lakes, following in this way the example set by the Hungarian Geographical Society some years ago in the scientific examination of Lake Balaton. The choice fell on the Lake of Bolsena, which seemed to possess particular advantages in its accessibility from Rome, and in the interest arising from its size, depth, and the geology of its neighbourhood. The lake had already been investigated with some care from certain points of view, the morphology of the basin having in particular been thoroughly elucidated by the soundings carried out by Dr. G. de Agostini, while its hydrography had also been studied by Sig. E. Perrone. But many of its phenomena still remained to be investigated, particularly its temperature relations and the phenomena of the nature of seiches. A special commission, consisting of Signors Novarese, Sella, Vinciguerra, and Palazzo, was nominated to carry out the observations, the results of which are to be published in the form of an exhaustive monograph. They have now been in progress for two years, and a

preliminary note on the methods employed and work accomplished was given by Prof. Palazzo in the *Bollettino* of the Italian Geographical Society for May, 1904. A base of operations was fixed upon in the town of Bolsena, where the use of certain rooms in a suitable building was obtained for the installation of the scientific instruments, etc. A complete series of observations on the air temperature, rainfall, and other meteorological elements is here carried out, while on the lake-shore a Sarasin limnograph and a gauge for recording the levels have been kept working. The former was fixed at the extremity of the jetty in the small harbour, a space being walled in, and the instrument protected as far as possible from the influence of the waves, communication with the lake outside being maintained by means of a pipe. The instrument is visited daily by Signor N. Mezzetti, of Bolsena, who also takes the level by the gauge, determines the temperature of the water, and notes the general conditions of the lake. A second station, somewhat less elaborately equipped, was established at the village of Marta on the opposite or southern shore. Here the houses touch the water, and some have basement chambers below the lake-level, so that a suitable location for the limnograph was easily found. The results obtained here were excellent, the records of seiches in the lake being unusually striking. Those due to longitudinal oscillations were particularly well marked, owing to the position of Marta almost at the southern end of the major axis of the lake, which has an elliptical form. Their period was about 14·75 minutes. It seems that the existence of these oscillations has long been known to the inhabitants, who say that they sometimes reach an amplitude of 30 cm. (almost a foot). The limnograph was constantly registering seiches of one sort or another, and regular series maintained for whole days were frequently obtained. At Bolsena the limnograph did not give such striking results; thus, while on July 21, 1903, a uninodal seich with an amplitude of over 17 cm. (6·7 inches) was recorded at Marta, the corresponding amplitude at Bolsena was only 9 cm. (3·6 inches). This is due to the greater distance of Bolsena from the end of the major axis of the lake, and the greater steepness of the shores at this part. The movements are also more complicated at Bolsena, and the existence of the oscillations had not previously been noticed there by the inhabitants. In addition to the main station at Bolsena, meteorological stations have been established at various points in the neighbourhood of the lake. Observations of the temperature of the water at the surface and at various depths have been taken regularly once a month, and were to be continued to the end of the second year. The colour and transparency of the water have also been observed. Prof. Palazzo hopes to give fuller details on all the observations in future articles.

The Platform of the High Summits of the Transylvanian Alps.—Mr. de Martonne has recently pointed out that the summits of the Transylvanian Alps do not possess the characteristics of high mountain peaks, although they rise to over 2400 metres. The undulatory plateau of Paringu is about 2000 metres (6600 feet), and further west the platform becomes more marked, and in the Boresco varies from 2050 to 2150 metres (6725 to 7050 feet) for several square kilometers. This can be traced into the Southern Retyezat, Tarco, and the *massif* of Godeanu, incised by narrow valleys to more than 1000 metres (3300 feet). The platform is continued in the Vulcan Mountains, and in those of Hermannstadt and Fogarash. This platform of Boresco, as he calls it, is thus a fundamental form in the Southern Karpathians. It nowhere coincides with the rock structure, but extends over crystalline and sedimentary rocks, and is an eroded surface with no deposits. It is a peneplain with an origin similar to that of the plateau of Mehedinti; and was formed in Palæogenic and early Neogenic times. The denudation of an elevated range explains the abundance of detritic sediments in the

Karpathian flysch. By the end of Miocene times, all traces of the old tectonic conditions had disappeared, except some valleys and heights of more resistant material. A Sarmatian elevation took place throughout the Transylvanian Alps, and is probably correlated with the folding of the flysch region, but was not accomplished without a tilting of the platform (Vulcan and Fogarash), and even its rupture at places. The cutting of gorges followed. Probably this was not the only elevation; for in certain valleys (of Vulcan) and interior sedimentary basins (Brezoin) there is an inferior platform—the valley platform. Hence, especially in the less resistant rocks, the post-Sarmatian erosion cycle enlarged the depressions and levelled part of the surface. This platform being carried to 700 and 800 metres (2300 and 2600 feet), a new movement took place, probably at the end of the Pliocene. The total rise in successive stages of this high plateau amounts to 1900 to 2000 metres, and is balanced by the sinking of the Hungarian and Valakhian (Wallachian) plains. The glaciation of the Southern Karpathians is partly due to this Pliocene elevation. Two types can be recognized, which may be used in classifying all the massifs of the High Karpathians: (1) the Boresco type, where the platform is the highest surface, and is notched by cirques as by giant quarries; (2) the Fogarash type, where the platform is dominated by the heights of the relic mountains (Monadnocks) of the Palæogenic erosion cycle, cut by glacial cirques, which give it a truly alpine appearance.—(*Comptes Rendus*, CXXXVIII., 6 juin, 1904.)

Navigable Waterways of Belgium.—A recent Consular Report (Miscellaneous, No. 604) on the Navigable Waterways of Belgium, gives their mileage at 1360, or 1 mile of waterway to every 8⅓ square miles of area. Directly controlling 85 per cent. of them, the State has during the last twenty-five years spent £16,000,000 on ports and canals alone. In return for this outlay, the volume of canal traffic has vastly increased, and goods are now in many instances transportable in barges of 300 tons direct from factory to seaport without reshipment—a saving in transport both of raw material and finished article. Barges at the port of Antwerp have, in the twenty years 1882–1902, increased in number by 17 per cent., and in tonnage by 270 per cent., the increase in tonnage being due to the fact that waterways have been made available for barges of greater draught, by which a large reduction in transport rates has been effected. In 1902 the number of barges entering the port of Antwerp was 31,850, of a gross tonnage of 5,705,731, whereof 3,710,813 tons were concerned with purely Belgian traffic, the rest with merchandise from Holland, Germany, and France. In 1882 there entered 27,998 barges of 2,079,658 gross tonnage. The increase in the twenty years is derived chiefly from the foreign trade, which shows an increase of 143 per cent. in the number of barges, and 367 per cent. in the tonnage. The Rhine barges carry goods without transhipment all the year round—unless when prevented by ice—between Antwerp, Cologne, and Mannheim, and from April to October also supply communication with Strassburg. Among the canals the improvement of which is projected, the Campine canals (including the junction canal between the Meuse and Scheldt, the Maastricht-Bois-le-Duc and Liége-Maastricht canals), at present 6 feet 10 inches, will be increased to 8 feet 2 inches in depth, and their bed widened from 32½ feet to 76½ feet, thus allowing the passage of 1000-ton barges as against 350-ton barges at present. The route from Antwerp to Paris *viâ* Brussels and Charleroi is, owing to the inferior capacity of the Brussels-Charleroi canal, available only for barges of not over 70 tons. Works now in progress will, when completed, open this canal to 400-ton barges. The total cost of the improvements is estimated at £2,145,200, one-half of which has been already spent. The improvements now being undertaken in the Ghent-Terneuzen canal will, when finished, allow of the

passage of far larger ships than at present. A new lock and a new outer port are to be constructed at Terneuzen. A new basin with five subsidiary wet docks is in course of construction at Ghent, while improvements are also being carried out at Bruges, Ostend, Brussels, and elsewhere.

Projected Railway from Turin to Martigny.—The *Tour du Monde* of June 11 last sketches this new railway project, which it considers likely to be put into execution before long. The line would have a total length of 157 kilometres (97½ English miles), with a maximum gradient of one in twenty, while the traction would be electric, power for this purpose being supplied by waterfalls. Breaking off from the line connecting Modane with Turin, the new line would cross the plains of the Canavese to Pont, entering the valley of the Orco, and passing by a tunnel under the Paradis *massif*; then, mounting halfway up the left flank of the Aosta valley, it would pass Morge and Courmayeur, whence, by tunnel under the Col de Ferret, it would run in Swiss territory along the Dranse to Martigny. The new line, it is pointed out, would have the advantage over the Mount Cenis, St. Gothard, and Simplon lines as the shortest route between North-Western Italy and the countries of Central Europe.

ASIA.

A Recent Journey in Mongolia.—The journeys of Mr. C. W. Campbell and Messrs. Russell and Hicks-Beach in Eastern Mongolia have been followed by one undertaken towards the end of last year by Mr. George J. Kidston, accompanied by Mr. A. J. Flaherty of His Majesty's Consular service, who went north from Peking, and beyond Dolon Nor followed a route to the west of Mr. Campbell's. Although the country had been previously visited by various travellers, the fact that few Englishmen have made themselves acquainted with this region gives a certain interest to the journey. An account of it has been printed in the form of a Parliamentary Report (China, Nos. 3 and 4, 1904), illustrated by photographs taken by the travellers, and by a map showing the general course of the route, compiled by Lieut.-Colonel Wingate of the Tien-tsin Intelligence Department. The route to Dolon Nor led at first north-east as far as Chengte or Jehol, instead of taking the more westerly direction *viâ* Kalgan followed by Mr. Campbell. Beyond the great wall the country becomes gradually poorer, crops becoming rarer and of poorer quality, while flocks and herds become more and more the main resource of the peasants. Most of the valleys are choked with masses of boulder, gravel, and sand, only a narrow band of cultivation intervening between this *débris* and the black rocks which bound the valleys. Dolon Nor, the chief trading centre of this region, sends to Tien-tsin considerable quantities of sheep and camel wool for shipment to England (and in the case of the former to Germany), salt being the next most important commodity. Beyond this the route led for 100 miles through a tract of sand-hills, and afterwards over the great grassy plain which rises gradually to the east to the great Khingan. Mr. Kidston seems to have been unprepared to find how little this had the character of a range when seen from the west, though its true character of somewhat broken escarpment of the plateau has long been realized by travellers in this region. The road across the plain was excellent, immensely wide, and usually as smooth as asphalt, so that apart from the occasional sand-hill belts, a bicycle or even a motor-car could be taken all the way to Khailar. The latter place formed the limit of the journey, for though the travellers had planned to go to Urga, the lateness of the season rendered this impracticable, the Gobi being deep in snow and quite impassable. As it was, intense cold was experienced before Khailar was reached (November 5), and the last part of the way was done through deep snow-drifts, through which only camels could pull the carts

The cold began with a change of wind to north-west on the evening of October 6, the minimum of that night being 3° Fahr., as compared with 42° the night before. Mr. Kidston's thermometer was broken after this, so no more readings were possible. During a furious blizzard refuge was taken at the camp of a Mongol prince, who rules over a very large district, and seems to have little felt the effect of Russian influence. Summing up his impressions of the country traversed, Mr. Kidston thinks it is doomed to continue much as at present, a waste spot inhabited only by wandering herdsmen. He saw no signs whatever of the construction of a railway such as was declared by Mr. Gerrare to have been begun from Khailar towards Kalgan, although the route crossed the supposed line at two separate points; and none of the inhabitants seemed aware that surveys even had been made. Besides, in Mr. Kidston's opinion, the sand-hill belt north of Dolon Nor would be an invincible obstacle, while water, wood, and stone are all equally wanting.

The Treaty with Tibet.—The negotiations which followed the successful entry of the British force into the Tibetan capital on August 3 were brought to a satisfactory issue early in September, when the treaty, to which, through the great tact and perseverance of Colonel Younghusband, the adhesion of the Tibetan authorities had at last been secured, was signed with due ceremony in the famous palace of Potala. Owing to the flight of the Dalai Lama, the Tibetans were represented during the negotiations by a regent and members of the Council of State, the Chinese Amban assisting in the discussions and, by the weight of his influence, doing much to bring about the successful result. On September 4 a preliminary function took place, at which the draft treaty was sealed by the regent. The formal ceremony, however, occurred on September 7, when the full convention was signed in the Potala in the presence of the Amban, the Tongsa Penlop of Bhutan, and the Nepalese resident. The seal of the Dalai Lama was affixed by the Regent, after which the seals of the Council, of the three great Monasteries, and of the National Assembly were added, Colonel Younghusband, the British Commissioner, then signing the document. In order to become fully valid, it has still to obtain the formal sanction of the Court of Peking, though of the ultimate acquiescence of this there seems little doubt. The main provisions of the treaty are said to be as follows, though no official version has yet been made public. The Tibetans are to re-erect the boundary stones at the Sikkim frontier; to establish marts at Yatung, Gyangtse, and Gartok for the furtherance of mutual trade; to adhere to a tariff to be agreed upon by the two countries; to pay an indemnity; and to demolish all forts on the trade-routes between the Indian frontier and Gyangtse. They also undertake not to make over Tibetan territory to any foreign Power without the consent of Great Britain, nor to permit foreign Powers to intermeddle in the Government or to construct roads or railways, open mines, etc. The Tashi (or Teshu) Lama of Shigatse has been proclaimed as the religious head of the country in the place of the Dalai Lama. The cordial relations established with the Tibetans as a whole are matter of much satisfaction, and both Colonel Younghusband and Brigadier-General Macdonald (both of them distinguished in the past for their geographical achievements) are to be warmly congratulated on the completion of their difficult mission.

Population of the Philippines.—The first Bulletin of the Census of the Philippine Islands, 1903, contains detailed tables of the population classified by provinces and commandancias, by islands, and by the smaller subdivisions of municipalities and barrios. There is hardly any attempt, however, to present the results in a generalized form, apart from the subdivision of the total number of inhabitants into civilized and wild. The number of the former is given as 6,987,686, of the latter as 647,740, the grand total being 7,635,426. It is evident,

however, that the figures given in the case of the wild inhabitants are estimated only, as they frequently appear as even hundreds or even thousands under the separate islands. The number of Negritos still remaining is estimated at 23,000, and they are said to be found in 22 provinces out of the total 50. The civilized population was grouped for the purposes of the census into the eight tribes of the Bicol, Cagayan, Ilocano, Pampangan, Pangasinan, Tagalog, Visayan, and Zambalan, the Visayan being the most numerous. No figures are, however, given in the present bulletin for the totals of each. The following are the figures for the total population of the more important islands: Bohol, 243,148; Cebu, 592,247; Leyte, 357,641; Luzon, 3,798,507; Mindanao, 499,634; Negros, 460,776; Panay, 743,646 Samar, 222,690. The total area of the islands is given as 115,026 square miles, or 73,616,640 acres, of which over 61,000,000 acres are public land. Of the latter 40,000,000 are forest lands, the rest being available for agriculture.

AFRICA.

M. Villatte's Surveys in the Central Sahara.—The last two numbers of *La Géographie* (July and August, 1904) contain further details respecting the work of M. Villatte, to which allusion was made in the September number of the *Journal*. A sketch-map is given, showing the general direction of the route, which led almost due south from Insalah, past Inzize and Timissao, terminating at the well of Tin-Zawaten on the Adrar plateau, just south of 20° N., in about 2° 25′ E. of Greenwich.* The more easterly return route skirted the Ahaggar *massif*, and crossed the Muidir plateau. The Adrar of the Ifoghas (not to be confounded with the Adrar in the Western Sahara, the name being used generically for a mountainous district), which had never before been visited by Europeans, is a vast granite plateau 2600 feet in average altitude, with ridges rising 1000 to 1300 feet above its surface. The first part of the return journey, which was begun on May 1, was trying on account of the length of the stages, the heat, and especially the scarcity of water; the wells, found at great intervals, giving a very scanty supply. Between 22° and 23° N. the ground for a distance of 30 miles was covered with volcanic *débris*, while some of the hills had every appearance of being extinct craters. About Tit, just north of 23°, the mountains are granitic. M. Foureau, in communicating this news, expressed the opinion that, as he had maintained for some time, the whole of the mapping of this region must, as a result of M. Villatte's survey, be shifted a considerable distance to the east. North of Tit the route traversed a country composed of chains running north-and-south, travelling in that direction being thus easy, while in an east-west direction it is proportionately difficult. Later, M. Villatte passed along the Tifedest *massif*, which ends towards the north in the Garet-ed-Jenun, a fine granite mountain, rising 2600 to 3000 feet above the plain. On reaching Insalah once more he compared his aneroid with the mercurial barometer which he had left behind there, and found that the correction necessary was identical with that noted before the expedition was made. His altitudes will, therefore, merit some confidence. He kept a daily meteorological record, and a comparison of his barometric observations with those made at Insalah brought out some interesting results, throwing light on the course of depressions in the Sahara, which seem sometimes to extend over a wide area.

The Cairo Observatory.—We are informed by the acting director of the Egyptian Survey Department that on January 1 of this year, the Abbasia Observatory was transferred to its new site at Helwan, about 14 miles south of Cairo. The

* The above is the longitude given in the sketch-map in the August number of *La Géographie;* in the former number the position of Tin-Zawaten was said to be in 1° 30′ E. [of Paris], *i.e.* 3° 50′ E. of Greenwich.

site is on the desert plateau above the town, and the buildings have an open view across the desert to the north, east, and south, while on the west is the Nile valley. A complete meteorological equipment and time-signal arrangement has been installed, and there is a transit house and an equatorial house, while a house for magnetic self-registering instruments is being constructed. The transit pillar is in lat. 29° 51′ 33″·5 N., long. 31° 20′ 30″·2 E., the latter value depending on that of the Venus station in the Mokattam hills (31° 16′ 33″·6 E.). The altitude of the cistern of the barometer above mean sea-level at Alexandria is 377·4 feet.

Opening of the Senegal-Niger Railway.—The railway from Kayes on the Senegal to Bamako on the Upper Niger, the construction of which was first commenced some twenty years ago, has been at last completed, the first train having reached Bamako in May last. The total length is 310 miles. For a time it seemed that, owing to the unexpected difficulties encountered, the railway would not advance beyond Bafulabe on the Upper Senegal, which was for some time the terminus. About 1896, however, a new effort was made to continue the line to the Niger, and it has now been crowned with success, although the importance of the line has somewhat diminished since the project for a railway from Konakri on the coast of French Guinea to the Upper Niger, by a route no longer than that of the older scheme, and avoiding the difficult navigation of the Senegal, took shape. The first section of this latter line, 92 miles long, was also opened for traffic in May last.

West African Frontier Delimitations.—Surveys for the purpose of boundary delimitation have lately been made, as our readers are aware, both on the frontier between the Kamerun and Northern Nigeria, and between the German colony of Togo and the Gold Coast. With regard to the first, some difference of opinion seems to have prevailed regarding the position of Yola, the exact fixing of which was one of the main tasks of the commission. According to a note in *Globus* (vol. 86, No. 9), the determination of the longitude of Yola by the German commission (which was under the experienced leadership of Captain Glauning) depended on three observations of the altitude, and six of the right ascension, of the moon, carried out with a transit instrument; and the result is said to merit complete confidence, when the observations shall have been fully worked out. The boundary from Yola to Lake Chad was carefully triangulated, so that, once the position of Yola is fixed, the rest will follow as a matter of course, the only divergence of opinion being in regard to the exact spot at which the boundary may be said to strike the lake-shore—at the limit of extreme inundation or otherwise. This is a point to be settled by the two Governments. With regard to the Togo—Gold Coast boundary, the survey of which was begun by a joint commission in 1902, there has been some difficulty in arriving at a mutual agreement regarding the position of the frontier through a portion of the old neutral zone, but this is said to have now been eliminated, though details of the arrangement have not been made public. An excellent map of the more northern section of the frontier, between 10° and 11° N., is given in the latest number of the *Mitteilungen aus den Deutschen Schutzgebieten* (1904, No. 3), as an accompaniment to a paper by Count Zech, one of the German commissioners. This paper gives valuable information on the peoples of the region in question, their manners and customs.

AMERICA.

Lakes Titicaca and Poopo.—As has already been mentioned in the *Journal*, a scientific study of these lakes has lately been carried out by Dr. Neveu-Lemaire, one of the members of the French expedition to Bolivia under M. de Créqui-Montfort. The principal results as regards the physical geography of the lakes

were outlined by Dr. Neveu-Lemaire in the June number of *La Géographie* (vol. ix. No. 6). The area of the water surface of Titicaca is estimated by the writer at 5100 square kilometres (1970 square miles), current estimates being, as a rule, much too high, as they include the area of the islands and peninsulas. About 120 soundings were effected, the Belloc sounding machine, as modified by Prof. Thoulet, being employed whenever the depth was greater than 10 metres. Dr. Neveu-Lemaire gives a bathymétric map on which the contours of 25, 100, and 200 metres are drawn. The deepest area lies nearer the north-east than the south-west shore, the contour-line of 200 metres approaching comparatively close to the former in two separate parts, while on the opposite side a wide band of regular breadth, with depths intermediate between 100 and 200 metres, runs parallel to the south-west shore. Soto island, the furthest from the shore of all the islands of the lake, rises abruptly from the deepest part, 270 metres (886 feet) being found at a little distance from its south end on the landward side, while the maximum depth (272 metres, or 892 feet) was found abreast of the island on the major axis of the lake. The "Little lake," joined to the "Great lake" in the south by a strait, is shallow, though the strait itself is fairly deep. Observations of much interest were obtained regarding the temperature of the lake water, though the stay was not long enough to throw light on seasonal variations, all the observations being made in early winter. The surface temperature was found to rise, as a rule, until 3 p.m., and then to fall again; but the greatest variation observed in a single day was 2°·82 Fahr., and this at a part of the lake where the depth varied greatly. The lowest surface temperatures observed naturally occurred in the shallow bays. The figures relating to the bottom temperatures are striking from their great regularity in spite of great differences of depth, the extreme variation being only 3°·6 Fahr. (from 48°·9 to 52°·5 Fahr., at 10 feet and 60 feet respectively). Below 240 metres (787 feet) the temperature was constant at 50°·82, the maximum being reached between 490 and 656 feet. A series of vertical temperatures near the centre of the lake showed a difference of only 1°·7 between the surface and the bottom. Observations were also taken of the transparency of the water, and of the climatic conditions, flora and fauna, etc., of the surrounding country. The level of the lake rises during the summer, the amount in 1903 being said to have been 5 inches; but apart from seasonal variation, the level is sinking progressively. Lake Poopo is very shallow, two small areas in the centre alone having a depth above 6½ feet (maximum 13 feet). It is evidently doomed to disappear in course of time.

Aves Island.—In the note of this island, in the September number, the latitude should read as 15° 38′ N., not 13° 38′, the latter figure being due to a printer's error.

MATHEMATICAL AND PHYSICAL GEOGRAPHY.

Changes of Level in the Mediterranean.—The evidences for considerable changes in the relative levels of the land and sea in the Mediterranean basin within the historical period continue to accumulate. The results of Mr. R. T. Günther's researches on the coasts of Southern Italy have from time to time appeared in the *Journal*, while at the recent meeting of the British Association he called attention to other points on the Italian shores, at which similar changes can be proved to have taken place. Mr. Hogarth and others have seen similar evidences in North Africa (Cyrene and Egypt), while the same story comes from the European side of the Eastern Mediterranean. M. P. Negris has put before the Paris Academy of Sciences (*C.R.*, vol. 137, p. 222; vol. 139, p. 379) facts which he has observed in Greece and the Archipelago which all tend to prove that the relative level of the sea in this region has risen about 3 metres, or 10 feet, since the time

of the Romans, and still more if we go back to an earlier date. The evidence is supplied by breakwaters and other artificial structures which are now submerged, though the purposes for which they were made show that originally they must have stood above sea-level. They occur at spots separated by wide intervals, viz. in the island of Leucadia (Santa Maura); at Itea, in the bay of Amphissa (Gulf of Lepanto); on the island of Ægina; and on Rhenea, or Great Delos; and the general agreement as regards the amount of change at all these places certainly seems to suggest the conclusion arrived at by M. Negris, that it is the sea-level and not that of the land which has fluctuated. Mr. Günther, it will be remembered, considered that the latter was the unstable element, and no doubt, in the volcanic region with which his researches were concerned, this would be the case. M. Negris seems to have found no trace of a land-level in mediæval times, still lower than the present, such as was demonstrated by Mr. Günther. It is to be hoped that the attention which has been attracted to the subject will lead to a more thorough search for evidences of fluctuation over the whole area, and that the doubtful points will in course of time be set at rest.

The Maximum Inclination of Screes and Talus-Slopes.—This subject has been investigated by Herr A. Piwowar, who gives the results of a large series of measurements in the *Vierteljahrschrift der Naturforschenden Gesellschaft in Zürich* for 1903. The writer finds that the angle of slope depends, most of all, on the *fracture* of the rocks which compose the heaps as determined by their internal texture and structure. The more massive, angular, and coarse-grained the rock, and the rougher its fracture, so much steeper will be the screes formed from it. On the other hand, the more laminated, rounded, and fine-grained the rock, and the smoother its fracture, so much more gradual will be the slope of its *débris*. The angle of slope is, in fact, a direct measure of the friction between the fragments of rock. Granite, a rock of the first category, was found to give a maximum angle of slope of 37°; while clay-slate, a laminated rock with smooth fracture, gave only 27½°. Intermediate between these extremes come rocks which are at the same time coarse-grained and laminated (*e.g.* gneiss or mica-schist), or which are smooth in fracture but massive (some kinds of limestone). These showed angles varying from 34° to 30°. Rocks which break into more or less flat fragments with smooth surfaces show a much greater constancy in the angle of slope than massive rocks, *e.g.* in the case of gneiss, the maximum and minimum observed differed only by 1° (34° and 33°), while in the case of granite the difference amounted to 11°. In the case of a mixture of rocks of different categories the angle is an intermediate one. It does not appear that the height of the cliff from which the *débris* has fallen exercises much influence, though there was some indication that a greater height of cliff gives a slightly smaller angle. Differences of aspect, with a corresponding difference in exposure to climatic factors, do not seem, either, to be of much importance. In the case of similar material, angularity of the fragments may increase the angle by as much as 3°. Slopes overgrown with vegetation may either be steeper or less steep than bare slopes. In the former case the result would be due to the compacting agency of the roots and humus, while in the latter the growth of the plants may be due to the greater age of the slopes, which would lead to a reduction of their angle of slope. The presence of water seems to reduce the angle, especially in the case of talus-slopes composed of small, smooth, or flat fragments. The average size of the fragments seems comparatively unimportant, although they are always arranged in the talus according to size, the largest lowest. Lastly, the writer found that under-water *débris*-slopes are about 1½° steeper than similar slopes exposed to the atmosphere, the effect of diminished weight outweighing that of diminished friction.

The Fifth Scientific Expedition of the "Princess Alice II."—The Prince of Monaco contributes a note to the *Comptes Rendus de l'Académie des Sciences* (vol. cxxxviii. No. 23, 6 juin, 1904), on the results of his latest expedition in the Bay of Biscay. Eighteen soundings, the deepest 4835 metres (2641 fathoms), were made with the Buchanan sounder furnished with a new tube which permitted longer cores to be obtained, revealing sudden variations in the composition of the bottom. Two dredgings at depths of 820 metres (448 fathoms), some 200 miles off Ushant, brought up many crystalline stones, about 100 kgs. (220 lbs.) in weight, undoubtedly of Northern origin transported by ice. Strong currents affect the water here to the very bottom. Prof. Thoulet, who accompanied the Prince, found out that certain coastal bottom deposits, treated with acids, gave off sulphuretted hydrogen; he verified the alteration in the buoyancy of pumice on sinking pieces to great depths; and made use of a mirror inclined to 45° looked at vertically when immersed to slight depths for judging the colour of the sea. Temperature observations were made at 50, 100, 150 metres (27, 54, and 82 fathoms), and in three instances at 500, 1000, and 1500 metres. Samples of water obtained below 1500 metres (820 fathoms) were occasionally slightly opaline, owing to suspended mud, although the bottom was 2000 to 3000 metres deeper. Many deep-sea dredgings of zoological interest were made, but the most important investigations were those on the sardines and the plankton on which they feed off the coast of Britanny. A rare medusa was taken from 1700 metres (930 fathoms), where the bottom was at 4360 metres (2383 fathoms), and several new species of crustaceans were netted.

GENERAL.

Routes from America to Eastern Asia.—In the Seattle *Post-Intelligencer* for May 15, 1904, Mr. A. J. Roewade refers to the misconceptions frequently prevailing, owing to the distortion due to the map-projections in common use, as to the most direct routes between the United States and Eastern Asia. He gives sketch-maps showing the direction taken by arcs of great circles between Puget sound and Yokohama, Irkhutsk, Calcutta, and the Philippines, which will no doubt cause surprise to many. Thus the most direct route from the north-westerly point of the United States to Calcutta passes through the centre of Alaska and *north* of Bering strait, passing only just to the south of Irkhutsk in its further course. Again, that from Cape Flattery, Washington, to Cape Bojeador in the Philippines, passes through the southern peninsula of Alaska and the island of Yezo, leaving the greater part of the island of Hondo on the outside. The conclusions drawn are that the project of a railway through Alaska and North-Eastern Siberia may be quite practicable in course of time, and that a great future lies before any halfway port that may be established by the United States in the Aleutian archipelago. The spot suggested for such a port is on Kiska island, where the United States Government is now preparing to establish a fortified coaling station.

OBITUARY.

Friedrich Ratzel.

In Friedrich Ratzel, who died suddenly on August 9 at Ammerland, on the Lake of Starnberg, the geographical world has lost one of its most learned and brilliant representatives.

Born at Karlsruhe on August 30, 1844, young Ratzel began life as an apothecary's

apprentice at the village of Eichtersheim, lying in the midst of a charming hill country between Heidelberg and Heilbronn. Having passed his pharmaceutical examination, he was occupied for some time as assistant in dispensaries at Mörs and at Rupperswyl, in Switzerland. During all this time he devoted his spare time to earnest study, whilst numerous pedestrian excursions supplied him with as many object-lessons in a knowledge of Nature, for which he had an abiding love. At length his parents yielded to his earnest desire that he might receive the benefits of a university training. At Heidelberg, Jena, and Berlin he studied natural science, and especially zoology, and in 1868 the first of these universities conferred upon him the degree of PHIL.DR., on the strength of a paper on the Oligochæta, a group of the Annelides. The winter of 1868–9 he spent at Montpelier and Cette, in intimate intercourse with the famous zoologist, Charles Martin. The "Zoologische Briefe vom Mittelmeer," which he addressed at that time to the *Kölnische Zeitung*, were so highly appreciated that the proprietors of that influential journal engaged him as a special travelling correspondent, thus realizing one of his most earnest desires by enabling him to gain a personal knowledge of a considerable portion of the Earth's surface. His travels, first of all, took him through Hungary, Transylvania, Italy, and Sicily, but on the outbreak of the Franco-German War in 1870, he joined a Baden regiment of infantry as volunteer, was seriously wounded at Auxerre, and returned home an invalid, but the proud possessor of the Iron Cross.

The year 1871 was profitably spent by him as a student at Munich, where the influence of Zittel, the geologist, and Moritz Wagner, the naturalist, determined his future career as a geographer.

In 1872 he resumed his work as a travelling correspondent, visiting in succession Italy and Sicily, the United States, Mexico, and Cuba. The works in which he renders an account of these travels—'Wandertage eines Naturforschers' (1873–4), 'Städte- und Kulturbilder aus Nordamerika' (1876), and 'Aus Mexiko' (1878)—abound in delightful sketches of land and people.

On his return from America in December, 1875, Ratzel qualified as *Docent* in geography at the Technical High School at Munich, by presenting an essay on Chinese emigration ("Die chinesische Auswanderung," 1876). In the following year he was appointed Professor. In 1886 he succeeded Peschel and Richthofen as Professor of Geography in the university of Leipzig, a position which he held up to the time of his premature death.

Ratzel was an indefatigable student, and a ready, voluminous writer. In numerous essays he dealt with nearly every branch of geographical study. In all he wrote he proved himself an original thinker, a careful observer, and a master of literary style. For a complete list of his works up to 1901, we must refer to the first report of the *Geographische Abende*, published by the Union of Leipzig Geographers. In what follows we shall refer only to his principal works, which have made his reputation, and have ensured him a place among the geographical thinkers of all time.

The first of these works, apart from books of travel already referred to, has for its title, 'Die Vereinigten Staaten von Nordamerika' (1878, 1880), a work dealing with the physical and political geography of the great American Union, which Elisée Réclus refers to as "perhaps the best and most complete treatise on the United States in any language."

His next work, 'Anthropogeographie' (i. 1882, 2nd edit. 1899; ii. 1891), is far more ambitious in its scope. It traces and exhibits the influence which the physical facts and environment have exercised and are exercising upon the history of mankind.

Of course, this philosophical method of dealing with geography was not new. Carl Ritter, not to trace its origin further back, had already laid down its principles in 1818, in the *Einleitung* to his general comparative geography, and it had been employed with more or less success by many pupils and followers of Ritter, among whom may be mentioned J. G. Kohl, E. Kapp, Guyot, C. F. A. Maury, and others, but it had never before been dealt with as comprehensively and thoroughly as was done by Ratzel. He must likewise be credited with having introduced the term "anthropogeography" in substitution for the rather vague terms of "general comparative" or "historical geography;" and although this term was at first objected to, it has now been fairly generally accepted by geographers.

Quite equal, if not superior, in merit to the work just mentioned, is the 'Politische Geographie,' published in 1897 (2nd edit. 1903), which applies the same comparative method when dealing with the 'Geography of States, Commerce and War,' a work well deserving the attention of statesmen and those aspiring to dispose of the destinies of states.

More popular in character is the 'Völkerkunde' (1885–8), a work rendered accessible to the English public by Mr. A. J. Butler's excellent translation ('The History of Mankind,' 1896–8). Another work of the same stamp is 'Die Erde und das Leben' (1901–2), described as a 'Comparative Geography' in the title; a short review of which will be found in the *Geographical Journal* (vol. xix. p. 500).

Shortly before his death, Ratzel published a work on the aspects of Nature ('Naturschilderung,' 1904); but a more ambitious work, upon which he had been employed for several years, and which was to have dealt with Biogeography in its widest sense, it was not given him to complete.

As a university professor, Ratzel exercised a wide and beneficent influence. His lectures, which dealt with every branch of geographical inquiry, were attended latterly by two or three hundred students, among whom were many foreigners. If the teaching of geography in Saxon schools compares favourably with what is done in other states of Germany, this, in no small measure, is due to his influence. His students revered their teacher, and on the twenty-fifth anniversary of his appointment as professor, they presented him with a "Ratzel Fund," the interest of which is to be devoted to assist geographical students in their researches. Among many pupils who enjoyed the advantage of his teaching, and who now occupy respected positions in the world of science, we may mention Prof. E. Oberhummer, of Vienna; Prof. Hassert, of Cologne; Prof. Werle, the director of the Anthropological Museum of Leipzig; A. M. Eckert, *Docent* in geography at Kiel; and H. F. Helmolt, the historian.

E. G. R.

Sir Michael Biddulph.

General Sir Michael Biddulph, R.A., G.C.B., etc., died on July 23 last, in his eighty-second year, at his residence in Whitehall Court. He had been a member of the Society since 1880. The deceased officer was the son of the Rev. T. S. Biddulph, of Amroth Castle, Pembrokeshire, and was educated at the Royal Military Academy, entering the Royal Artillery in 1843. He served with distinction throughout the Crimean war, but the greater part of his military service was connected with India. From 1876 to 1878 he was in command of the Rohilkand district, afterwards commanding the Quetta field force and the second division of the Kandahar field force during the Afghan war of 1878–79. During the campaign he and his troops made many long and trying marches, pushing their way as far as the Helmand river.

This work gave some scope for his geographical leanings in a country then but imperfectly known, and during a short furlough, in 1880, he read before the Society a valuable paper on 'Pishin and the routes between India and Candahar,' which was printed in the *Proceedings* for that year, illustrated by excellent sketches of the country. Indirectly he had done much to further geographical knowledge by the help and encouragement he gave to the survey officers deputed to work with his column, among whom were included men afterwards well known in the geographical world, such as Sir Thomas Holdich, General Woodthorpe, and Colonel Tanner. Leaving India in 1886, Sir Michael became president of the Ordnance Committee, a post which he held till 1889. He was Groom-in-Waiting to Queen Victoria for a number of years, and Keeper of the Regalia at the Tower of London from 1891 to 1896, when he became Gentleman Usher of the Black Rod, retaining the post till his death.

Major G. H. Bretherton.

The country has lost the services of a most promising officer by the death of Major G. H. Bretherton, D.S.O., which occurred by drowning in the Sanpo during the crossing of that river by the British expedition *en route* for Lhasa. He was born in 1860, the son of the late Edward Bretherton, of Clifton, and entering the army served in Egypt and on the north-west frontier of India, where he was for some years on special duty in Gilgit and Kashmir, doing excellent service. He had been chief transport officer to the Tibet expedition, and in this capacity performed arduous and invaluable services in the face of great difficulties. A journey which he made in 1901 by a new route across the Himalayas, from the Indus to the Kashmir valley, was briefly described in the *Journal* for May, 1902.

The Hon. John Douglas.

The Hon. John Douglas, Governor of Thursday island, whose death, on July 22 last, we regret to record, was an old member of our Society, having joined in 1870. He was born in 1828, and his father, the late Henry A. Douglas, was brother of the fifth and sixth Marquises of Queensberry. After graduating at Durham University in 1850, Mr. Douglas settled in New South Wales, and in 1859 and following years had a seat in the parliament of that colony. But in 1863 he moved to Queensland, with which he maintained his connection during the remainder of his life, holding various posts in the government, and representing the colony as Agent-General in London in 1870–71. In 1878 he became Colonial Secretary, and in 1885 Resident at Thursday island, returning to the same post in 1889, after holding the post of Special Commissioner for British New Guinea for three years, after the death of Sir Peter Scratchley. He had remained in charge at Thursday island until the last, his death occurring on the island. He was the author of interesting papers on Thursday island and Torres strait, published in the *Queensland Geographical Journal* and elsewhere.

The Rev. François Coillard.

Since the Upper Zambezi region was first opened to civilizing influences by the labours of Livingstone, no one man has been so completely identified with the furtherance of the good work so inaugurated as the Rev. F. Coillard, whose death, we regret to record, took place at Lialui on May 27 last. M. Coillard, as is well known, was a French Protestant missionary, who began work in Basutoland in 1857, afterwards pushing further into the interior, and finally establishing a

mission in the Barotse country over twenty years ago. Every traveller who has since visited that region has borne testimony to the excellence of his work, which he had begun to see bearing fruit in spite of many discouragements. M. Coillard married, in 1860, a daughter of the Rev. L. Mackintosh, of Edinburgh; and was throughout a warm advocate of the extension of British influence in the Zambezi basin, as furthering the best interests of the native races. In 1897–98, M. Coillard published, both in English and French, an account of his labours, which incidentally supplied valuable information on the Marotse and their country.

CORRESPONDENCE.

The Survey of Canada.

The August number of the *Journal* contains a review on my "Report on the Survey of Canada," wherein the reviewer attributes to me the strange opinion that an absolute determination of longitude can be made with about the same degree of accuracy as that involved in a determination of latitude. I am afraid a carelessly worded sentence must have misled him. I certainly never entertained such an idea, and I fully concur that absolute determinations of longitude, *i.e.* determinations other than those made by exchange of telegraphic signals, have no place in a scientific survey.

E. H. Hills.

War Office, Sept. 19, 1904.

GEOGRAPHICAL LITERATURE OF THE MONTH.

Additions to the Library.

By EDWARD HEAWOOD, M.A., *Librarian*, R.G.S.

The following abbreviations of nouns and the adjectives derived from them are employed to indicate the source of articles from other publications. Geographical names are in each case written in full:—

A. = Academy, Academie, Akademie.
Abh. = Abhandlungen.
Ann. = Annals, Annales, Annalen.
B. = Bulletin, Bollettino, Boletim.
Col. = Colonies.
Com. = Commerce.
C. R. = Comptes Rendus.
E. = Erdkunde.
G. = Geography, Géographie, Geografia.
Ges. = Gesellschaft.
I. = Institute, Institution.
Iz. = Izvestiya.
J. = Journal.
Jb. = Jahrbuch.
k. u. k. = kaiserlich und königlich.
M. = Mitteilungen.
Mag. = Magazine.
Mem. (mém.) = Memoirs, Mémoires.
Met. (mét.) = Meteorological, etc.
P. = Proceedings.
R. = Royal.
Rev. (Riv.) = Review, Revue, Rivista.
S. = Society, Société, Selskab.
Sc. = Science(s).
Sitzb. = Sitzungsbericht.
T. = Transactions.
Ts. = Tijdschrift, Tidskrift.
V. = Verein.
Verh. = Verhandlungen.
W. = Wissenschaft, and compounds.
Z. = Zeitschrift.
Zap. = Zapiski.

On account of the ambiguity of the words *octavo*, *quarto*, etc., the size of books in the list below is denoted by the length and breadth of the cover in inches to the nearest half-inch. The size of the *Journal* is 10 × 6½.

A selection of the works in this list will be noticed elsewhere in the "Journal."

EUROPE.

Italy. **Baedeker.**

Italy from the Alps to Naples. Handbook for Travellers, by Karl Baedeker. Leipsic: Karl Baedeker, 1904. Size 6½ × 4½, pp. xlii. and 424. *Maps and Plans.* *Price* 8*m.* *Presented by the Publishers.*

Italy—Bibliography. *Rev. G. Italiana* **10** (1903): pp. 112. **Magistris.**

Bibliografia Geografica della regione Italiana, Anno ii., 1902.

Italy—Geodesy. **Cattolica.**

Operazioni Astronomico-Geodetiche esequite negli anni 1901–02 a Portofino (Monte del Telegrafo) nell' Isola Maddalena (Semaforo Guardia Vecchia) ed a Livorno (Accademia Navale). Resoconto del Cap. P. L. Cattolica. Genova, 1904. Size 13½ × 9½, pp. x. and 82. *Presented by the R. Istituto Idrografico, Genoa.*

Italy—Hydrography. **Cattolica.**

V° Congresso Geografico Italiano, Napoli, 9 Aprile 1904. Lo stato attuale della Cartografia Nautica Italiana ed i lavori delle future campagne idrografiche. Comunicazione del Capitano P. L. Cattolica. Genova, 1904. Size 11 × 8, pp. 8. *Index Maps. Presented by the R. Istituto Idrografico, Genoa.*

Italy—Sardinia. *B.S.G. Italiana* **5** (1904): 315–351. **Gestro.**

Una gita in Sardegna. Divagazioni biogeografiche del dott. R. Gestro. *With Sketch-maps and Illustrations.*

Italy—Sicily—Rivers. *Atti R.A. Lincei, Rendiconti* **13** (1) (1904): 707–713. **Eredia.**

Sulla previsione delle piene dei fiumi in Sicilia. Nota del dott. F. Eredia.

Norway—Glommen. *Norske G.S. Aarbog* **14** (1902–3): 96–102. **Reusch.**

Glommens bøining ved Kongsvinger. Af Dr. Hans Reusch.

On the origin of the bend of the Glommen at Kongsvinger.

Norway—Orography—Historical. *Norske G.S. Aarbog* **14** (1902–3): 1–36. **Haffner.**

Det norske fjeldsystem. Af Einar Haffner.

Mainly on the historical development of a knowledge of the mountains of Norway.

Rumania. **Sturdza.**

Alexandre A. C. Sturdza. La Roumanie n'appartient pas à la péninsule balkanique proprement dite ni comme sol, ni comme race, ni comme état. Traduction Française. Bucarest: J. V. Socecu, 1904. Size 9½ × 6½, pp. 32. *Maps. Presented by the Societatea Geografică Română.*

Urges that Rumania should not be included by map-makers as part of the "Balkan Peninsula." (See note in the Monthly Record for September, p. 345.)

Russia. ——

Commercial Russia in 1904. Area, population, finances, currency, railways, industry and agriculture, and Foreign Commerce and Commerce of United States with Russia. [From the *Monthly Summary of Commerce and Finance* for February, 1904.] Washington, 1904. Size 11½ × 9, pp. 2755–2870. *Map.*

Russia—Black Sea Coast. *Scottish G. Mag.* **20** (1904): 285–305. **Dingelstedt.**

The Riviera of Russia. By V. Dingelstedt. *With Illustrations.*

Russia—Finland. **Heinrichs.**

Observations météorologiques publiées par l'Institut Météorologique Central de la Société des Sciences de Finlande. État des glaces et des neiges en Finlande pendant l'hiver 1892–1893 exposé par Axel Heinrichs. Kuopio: Imp. K. Malmström, 1904. Size 15 × 10, pp. 78. *Maps.*

Scheldt. *B.S.R. Belge G.* **28** (1904): 97–109. **Cornet.**

L'Orientation des Vallées dans le bassin de l'Escaut. Par J. Cornet.

Sweden—Flora. **Schulz.**

A. Schulz: Ueber die Entwicklungsgeschichte der gegenwärtigen phanerogamen Flora und Pflanzendecke Schwedens. (Sonderabdruck aus den Berichten der Deutschen Botanischen Gesellschaft., Jahrg. 1904, Band XXII., Heft 2.) Berlin: Gebrüder Borntræger, 1904. Size 10 × 6½, pp. 133–143. *Presented by the Author.*

Combats some of the views put forward by Dr. Gunnar Andersson.

Switzerland. **Coolidge.**

Conway and Coolidge's Climbers' Guides. The Bernese Oberland. Volume ii. From the Mönchjoch to the Grimsel. By W. A. B. Coolidge. London: T. Fisher Unwin, 1904. Size 5½ × 4, pp. xxviii. and 196. *Price* 10*s. Presented by the Publisher.*

Switzerland. *Le Globe, B.S.G. Genève* **43** (1904): 23–30. **Krafft.**

Le lac d'Ægeri et Morgarten. Par A. Krafft. *With Map.*

Switzerland. ——

Handbook for Switzerland and the Adjacent Regions of the Alps. Nineteenth Edition. London: E. Stanford, 1904. Size 7 × 5, pp. cvi. and 556. *Maps and Plans. Price* 10*s*. *Presented by the Publisher.*

This edition has been completely remodelled and thoroughly revised, with a view to bringing it into line with the changed conditions of modern travel, and in the hope that it may "become as indispensable to travellers in Switzerland as in former days the earlier editions were to the predecessors of the present race of Swiss tourists."

Switzerland. **Stebler.**

Das Goms und die Gomser. Von F. G. Stebler. (Beilage zum Jahrbuch S.A.C., Band xxxviii.) Zürich: F. Amberger vorm. D. Bürkli, 1903. Size 10½ × 7½, pp. viii. and 112. *Map and Illustrations.*

Switzerland—Flora. **Schulz**

Entwickelungsgeschichte der gegenwärtigen phanerogamen Flora und Pflanzendecke der Schweiz. Von A. Schulz. (Abdruck aus: Beihefte zum Botanischen Centralblatt, Band XVII., Heft 1, 1904.) Jena: G. Fischer. Size 9½ × 6½, pp. 157–194. *Presented by the Author.*

Criticizes the recent work of Marie Jerosch (cf. *ante*, p. 333).

Switzerland—Geographical Dictionary. **Knapp, Borel, and Attinger.**

Geographisches Lexikon der Schweiz mit dem Beistande der Geographischen Gesellschaft zu Neuenburg herausgegeben unter der Leitung von C. Knapp, M. Borel, und V. Attinger. . . . Deutsche Ausgabe besorgt von H. Brunner. Zweiter Band. Emmenholz—Kraialppass. Neuenburg: Gebrüder Attinger, 1904. Size 11 × 7½, pp. viii. and 768. *Maps and Illustrations. Presented by Herr H. Brunner.*

Switzerland—Hydrology. ——

Table de Récapitulation des Principaux Résultats des Observations hydrométriques suisses pour l'année 1893. Ditto 1899. Bern, 1903. Size 15 × 10, pp. 40 and 52.

Switzerland—Hydrology and Meteorology. ——

Tableaux graphiques des Observations hydrométriques suisses et des températures de l'air et des hauteurs pluviales pour l'année 1902. Bern, 1903. Size 15½ × 10, pp. 20. *Diagrams.*

Switzerland—Population. *Jahresb. G. Ges. Bern* **18** (1900–1902): 129–167. **Zivier.**

Die Verteilung der Bevölkerung im Oberrheingebiet nach ihrer Dichte. Ein Beitrag zur Anthropogeographie des Kantons Graubünden. Von Dr. H. Zivier. *With Map.*

Switzerland—Relief. *Jahresb. G. Ges. Bern* **18** (1900–1902): 1–38. **Liez.**

Die Verteilung der mittleren Höhe in der Schweiz. Von Dr. H. Liez. *With Maps.*

Turkey—Bosporus. *Deutsch. Rundschau G.* **26** (1904): 393–397. **Braun.**

Griechische Walddörfer am Bosporus. Von F. Braun.

United Kingdom—Ireland. **Lamplugh and others.**

Memoirs of the Geological Survey, Ireland. The Geology of the country around Belfast. (Explanation of the Belfast Colour-printed Drift Map.) By G. W. Lamplugh, J. R. Kilroe, A. M. Henry, H. J. Seymour, W. B. Wright, and H. B. Muff. Dublin; London: E. Stanford, 1904. Size 10 × 6½, pp. viii. and 166. *Illustrations. Price* 3*s*.

ASIA.

Chinese Empire—Tibet. *Iz. Russian G.S.* **39** (1903): 437–479. **Grum-Grjimailo.**

Contribution to the Ethnology of Amdo and Kuku Nor district. By G. E. Grum-Grjimailo. [In Russian.]

Chinese Empire—Tibet. *Petermanns M.* **50** (1904): 107–112. **Schlagintweit.**

Tibet. Von Dr. E. Schlagintweit. *With Map.*

Chinese Empire—Tibet. *Z. Ges. Erdk. Berlin* (1904): 328–361. **Tronnier.**

Die Durchquerung Tibets seitens der Jesuiten Johannes Grueber und Albert de

Dorville im Jahr 1661. Eine Studie über das Leben und die Reise der beiden Väter. Von R. Tronnier. *With Map.*

An abstract of this paper will be given elsewhere.

Chinese Empire—Tibet. *Monthly Rev.* **15** (1904): 41–54. **Wylly.**

British Relations with Thibet. By H. C. Wylly.

Eastern Asia. *Monthly Weather Rev.* **32** (1904): 124-125. **Garriott.**

Climate of Siberia, Korea, and Manchuria. By Prof. E. B. Garriott.

Eastern Asia. **Krahmer.**

Russland in Asien. Band vii. Die Beziehungen Russlands zu Japan (mit besonderer Berücksichtigung Koreas). Von Krahmer. Leipzig: Zuckschwerdt & Co., 1904. Size 9½ × 6½, pp. viii. and 222. *Map.*

French Indo-China. *B. Comité l'Asie Française* **4** (1904): 220–224. ——

Une Nouvelle Voie d'accès de la côte annamitique au Mékong. Par R. C. *With Map.*

India—Burma. **Nangle.**

The Burma Route Book. Part i. Routes in Northern Burma. Compiled by Captain M. C. Nangle, for the Intelligence Branch, Quarter-Master General's Department, Simla. 1903. Calcutta, 1904. Size 13½ × 8½, pp. 206. *Index Map. Presented by the Intelligence Branch, Simla.*

India—Census. ——

East India (Census). General Report of the Census of India, 1901. London: Eyre & Spottiswoode, 1904. Size 13½ × 8½, pp. xxvi. and 582. *Maps. Price* 8*s.* 3*d.*

A most valuable account of the results of the census in a generalized form. It will receive special notice.

India—Himalayas. *Alpine J.* **22** (1904): 122–124. **Freshfield.**

How to climb Kangchenjunga: a Topographical Note. By D. W. Freshfield. *With Illustration.*

India—Himalayas. *Appalachia* **10** (1904): 241–255. **Workman**

Ascent of the Great Chogo Loongma Glacier, and other Climbs in the Himalayas. By Fanny Bullock Workman. *With Illustrations.*

India—Kolar Gold Field. *B. Mysore Geolog. Dep.* No. 2 (1904): pp. 48. **Smeeth.**

Air Blasts and Quakes on the Kolar Gold Field. By W. F. Smeeth. *With Illustrations.*

India—Languages. *Imp. and Asiatic Quarterly Rev.* **17** (1904): 267–286. **Grierson.**

The Languages of India, and the Census of 1901. By G. A. Grierson.

India—North-West Frontier. ——

Administration Report of the North-West Frontier Province from 9th November, 1901, to March, 1903. Peshawar, 1903. Size 13½ × 8½, pp. iv., viii., and 76. *Presented by the Chief Commissioner North-West Frontier Province.*

Of special interest on account of the recent inauguration of the province, of the physical features and history of which a sketch is given.

India and Ceylon—Railways. **Trott.**

Index to all Railway and Military Stations, and Mileage Book for Trott's Coloured Map of Railways in India, Burma, and Ceylon, as compiled for the Bengal Nagpur Railway Company. By J. Harrington Trott. Calcutta, 1903. Size 13½ × 8½, pp. [18], xxxvii., and 60. *Map. Presented by J. H. Trott, Esq.*

Indian Ocean—Kerguelen Island. *Questions Dipl. et Colon.* **17** (1904): 748–753. **Bull.**

L'île de Kerguelen. Par H. J. Bull. *With Maps.*

Indian Ocean—Maldive and Laccadive Islands. **Gardiner.**

The Fauna and Geography of the Maldive and Laccadive Archipelagoes. Edited by J. S. Gardiner, Vol. ii., Part iii. Cambridge: the University Press; London: C. J. Clay & Sons, 1904. Size 11½ × 9, pp. 669–806. *Plates. Price* 15*s. net.*

All the reports in this part refer to animal life.

Indo-China. *La G., B.S.G. Paris* **9** (1904): 376–379. **Aïtoff.**

Le traité franco-siamois. Par D. Aïtoff. *With Map.*

On the map, the explanations of the two kinds of diagonal hatchings have been

accidentally interchanged. The statement that the police of the provinces of Battambang, etc., is to be placed under French officers, is also puzzling.

Indo-China. *Deutsch. Rundschau G.* **26** (1904): 370–371. ———

Die neue französisch-siamesische Grenze. *With Map.*

Indo-China—Funan. *J. Asiatique* **1** (1903): 109–150. **Aymonier.**

Le Founan. Par É. Aymonier.

Indo-China—Moïs. **Gautier.**

B.S.G. Com. Havre **19** (1902): 95–109, 172–182, 234–248; **20** (1903): 305–317, 371–379, 428–440.

Etude sur les Moïs. Par A. Gautier.

Japan. **Reynoso.**

En la Corte del Mikado. Bocetos Japoneses por D. Francisco de Reynoso. Madrid, 1904. Size 9 × 6, pp. xiv. and 448. *Presented by the Author.*

Japan. ———

Commercial Japan in 1904. Area, Population, Production, Railways, Telegraphs, and Transportation Routes, and Foreign Commerce and Commerce of United States with Japan. (From the *Monthly Summary of Commerce and Finance* for February, 1904.) Washington, 1904. Size 12 × 9, pp. 2873–3018. *Map.*

Japan. ———

Imperial Geological Survey of Japan, with a catalogue of articles and analytical results of the specimens of soils exhibited at the Louisiana Purchase Exposition held at St. Louis, Missouri, United States of America, in 1904. Tōkyō: The Imperial Geological Survey of Japan, 1904. Size 10½ × 7½, pp. 60 and 16. *Maps and Portraits.*

Contains a sketch of the history and work of the geological survey of Japan.

Japan—Geology. ———

Outlines of the Geology of Japan: Descriptive Text to accompany the Geological Map of the Empire on the Scale 1 : 1,000,000. Compiled by the officials of the Imperial Geological Survey of Japan, Department of Agriculture and Commerce. Tokyo: The Geological Survey, 1902. Size 9½ × 7, pp. vi. and 252. *Presented by the Imperial Geological Survey, Japan.*

See review in the September number, p. 335.

Korea. *Fortnightly Rev.* **75** (1904): 946–954. **Hillier.**

Korea: its History and Prospects. By Sir W. C. Hillier, K.C.M.G., C.B.

Korea. **Lay.**

Trade of Corea for the year 1903. Foreign Office, Annual, No. 3220, 1904. Size 10 × 6½, pp. 18. *Price* 1½*d.*

Korea. ———

Commercial Korea in 1904. Area, Population, Production, Railways, Telegraphs, and Transportation Routes, and Foreign Commerce and Commerce of United States with Korea. (From the *Monthly Summary of Commerce and Finance* for January, 1904.) Washington, 1904. Size 12 × 9½, pp. 2449–2482. *Maps.*

Malay Archipelago—Celebes. *Petermanns M.* **50** (1904): 128–129. **Foy.**

Ueber die Herkunft des Namens "Celebes." Von Dr. W. Foy.

Malay Archipelago—Celebes. *Petermanns M.* **50** (1904): 80. **Sarasin.**

Ueber die Herkunft des Namens "Celebes." Von Dr. F. Sarasin.

The explanation given was subsequently contested (see above).

Malay Archipelago—Sumatra. *Globus* **86** (1904): 24–30. **Hagen.**

Die Gajos auf Sumatra. Von Dr. B. Hagen. *With Illustrations.*

Philippine Islands. **Blair and Robertson.**

The Philippine Islands, 1493–1898. Edited and annotated by E. H. Blair and J. A. Robertson, with historical introduction and additional notes, by E. G. Bourne. Vol. xi., 1599–1602 (pp. 320); vol. xii., 1601–1604 (pp. 324); vol. xiii. 1604–1605 (pp. 318); vol. xiv., 1605–1609 (pp. 342); vol. xv., 1609 (pp. 332). Cleveland, Ohio: The Arthur H. Clarke Co., 1904. Size 10 × 6½. *Maps and Plates.*

Philippine Islands—Bibliography. **Griffin and Phillips.**

A List of Books (with references to Periodicals) on the Philippine Islands in the

Library of Congress, by A. P. C. Griffin, with Chronological List of Maps in the Library of Congress, by P. Lee Phillips. Washington, 1903. Size 11 × 7½, pp. xvi. and 398. *Presented by the Library of Congress.*

AFRICA.

British East Africa. *J. Anthrop. I.* **33** (1903): 325–359. **Hobley.**

British East Africa. Anthropological Studies in Kavirondo and Nandi. By C. W. Hobley. *With Plates.*

British East Africa—Kikuyu Language. **McGregor.**

English-Kikuyu Vocabulary. Compiled for the use of the C.M.S. Missions in East Africa. By A. W. McGregor. London: Society for Promoting Christian Knowledge, 1904. Size 6½ × 4½, pp. 192. *Presented by the Author.*

Congo—Fever. **Védy.**

La fièvre bilieuse hémoglobinurique dans le Bassin du Congo. Par le Dr. L. Védy. Bruxelles, 1904. Size 10 × 6½, pp. 116. *Presented by the Author.*

Congo State. *La G., B.S.G. Paris* **9** (1904): 431–444. **Brumpt.**

Mission du Bourg de Bozas. IIIe Partie. Du Nil à l'Atlantique. Par E. Brumpt. *With Map.*

Congo State—Katanga. *Mouvement G.* **21** (1904): 169–174, 181–185. **Lattes.**

Les voies navigables au Katanga; reconnaissances du lieutenant Lattes. *With Maps.*

See note in Monthly Record for September (p. 350).

Dahome. **François.**

Renseignements Colon., Comité l'Afrique Française, Nos. 4 and 5 (1904): 97–103, 132–136.

Le Royaume du Porto-Novo. Par G. François.

Egypt—Historical. **Budge.**

Lady Meux Manuscript No. 6. The Book of Paradise; being the Histories and Sayings of the Monks and Ascetics of the Egyptian Desert, by Palladius, Hieronymus, and others. The Syriac Texts, according to the Recension of 'Anân-Îshô of Bêth 'Âbhê, edited with an English translation, by E. A. Wallis Budge. 2 vols. London, 1904. Size 11½ × 7½, pp. lxxviii., 1096, and 768. *Presented by Lady Meux.*

Egypt—Sinai. *Globus* **85** (1904): 249–253. **Schoenfeld.**

Die Halbinsel Sinai, auf Grund eigener Forschung dargestellt von Prof. Dr. E. D. Schoenfeld.

Egyptian Sudan. *J. R. Colonial I.* **35** (1904): 486–513. **FitzGerald.**

The Commercial possibilities of the Sudan. By W. W. A. FitzGerald.

Egyptian Sudan. *B.S. Khédiv. G.* **6** (1904): 171–183. **Tappi.**

De pays des Chillouks. Par le R. P. Tappi. *With Map.*

Eritrea. *B.S.G. Italiana* **5** (1904): 352–377. **Tancredi.**

Chenafená. Note del A. M. Tancredi. *With Sketch-maps and Diagram.*

German East Africa. **Koert.**

Berichte Land- u. Forstwirtschaft Deutsch-Ostafrika **2** (1904): 143–164.

Geologisch-agronomische Untersuchung der Umgegend von Amani in Ostusambara. Von Dr. W. Koert. *With Map.*

German East Africa. *M. Deutsch-Schutzgeb.* **17** (1904): 97–98. **Sprigade.**

Begleitworte zu der Karte der Gebiete am Südlichen Tanganjika- und Rukwa-See. Von P. Sprigade. *With Map. Also separate copy presented by the Author.*

The excellent map, largely based on the surveys of Capt. von Prittwitz u. Gaffron, is on the scale of 1 : 500,000.

German East Africa. **Tornau**

Berichte Land- u. Forstwirtschaft Deutsch-Ostafrika **2** (1904): 128–142.

Die geologischen und hydrographischen Verhältnisse an der Karawanenstrasse Kilwa-Songea, Reisebericht des K. Geologen D. F. Tornau. *With Map and Plate.*

German East Africa—Survey. *M. Deutsch. Schutzgeb.* **17** (1904): 99–106. **Techmer.**
Photogrammetrische Aufnahme in West-Usambara, Deutsch-Ostafrika. Von F. Techmer. *With Illustrations.*

German South-West Africa. *Globus* **85** (1904): 338–341, 348–352. **Gessert.**
Ueber Rentabilität und Baukosten einer Kunene-Ableitung. Von F. Gessert.
On a proposed scheme of diverting the Kunene for irrigation purposes.

German South-West Africa. **Hanemann.**
Wirtschaftliche und politische Verhältnisse in Deutsch-Südwest-Africa. Von Dr. Hanemann. Berlin: Deutscher Kolonial-Verlag (G. Meinecke), 1904: Size 10 × 6½, pp. 62.

Kamerun. *Globus* **85** (1904): 265–269, 333–337. **Bauer.**
Bilder aus dem deutschen Tsadsee-Gebiet. Von F. Bauer. *With Illustrations.*

Kamerun. *G.Z.* **10** (1904): 1–13, 74–86, 121–134, 203–218. **Hutter.**
Landschaftsbilder aus Kamerun. Von Hauptmann a. D. Hutter. *With Illustrations.*

Kamerun. *M. Deutsch. Schutzgeb.* **17** (1904): 87–88. **Moisel.**
Notiz zur Karte des Crossfluss-Gebietes zwischen Nssakpe und Ossidinge. Von M. Moisel. *With Map.*

Madagascar. *C. Rd.* **138** (1904): 1318–1321. **Colin.**
Observations magnétiques à Tananarive. Par le P. Colin.

NORTH AMERICA.

Alaska. **Mendenhall and Schrader.**
The Mineral Resources of the Mount Wrangell District, Alaska. By W. C. Mendenhall and F. C. Schrader. (United States Survey, Professional Paper, No. 15.) Washington, 1903. Size 11½ × 9, pp. 72. *Maps and Illustrations. Presented by the U.S. Geological Survey.*

Alaska. **Putnam.**
Geographic Names in Alaska. Native Names for Localities on St. George Island, Bering Sea. Compiled by G. R. Putnam. (Appendix, No. 7, Coast and Geodetic Survey Report, 1903, pp. 1013–1016.) Washington, 1903.

Alaska. ———
Commercial Alaska, 1867–1903. Area, Population, Production, Railways, Telegraphs, Transportation Routes, and Commerce with the United States and Foreign Commerce. (From the *Summary of Commerce and Finance* for July, 1903.) Size 11½ × 9½, pp. 37–118. *Map.*

Canada. *Globus* **85** (1904): 379–383. **Bach.**
Die Grenze zwischen Britisch-Columbia und dem Kanadischen Yukongebiete. Von R. Bach. *With Map and Illustrations.*

Canada—Bay of Quinte. *J. Geology* **12** (1904): 106–132. **Wilson.**
Cuspate Forelands along the Bay of Quinte. By A. W. G. Wilson. *With Map, Plans, and Illustrations.*

Canada—British Columbia. **Herring.**
In the Pathless West, with Soldiers, Pioneers, Miners, and Savages. By Frances E. Herring. London: T. Fisher Unwin, 1904. Size 8 × 5½, pp. xii. and 240. *Illustrations. Price 6s net. Presented by the Publisher.*
Somewhat discursive sketches of life in the early days of British Columbia.

Canada—British Columbia. ———
Annual Report of the Minister of Mines for the year ending December 31, 1903, being an account of Mining Operations for Gold, Coal, etc., in the Province of British Columbia. Victoria, B.C., 1904. Size 10½ × 7½, pp. 276. *Maps and Illustrations.*
The high figure of the yield for 1901 has not been maintained in the two succeeding years, but 1903 shows a slight excess over 1902.

Canada—Muskoka. **Podmore.**
A Sporting Paradise, with Stories of Adventure in America and the Backwoods of Muskoka. By P. St. Michael Podmore. London: Hutchinson & Co., 1904. Size 8½ × 6, pp. xii. and 274. *Illustrations. Price 7s. 6d. Presented by the Author.*

Newfoundland. *J.R. Colon. I.* **35** (1904): 532–546. **Boyle.**

Newfoundland, the Ancient Colony. By Sir C. Boyle, K.C.M.G.

Newfoundland—Currents. **Dawson.**

The Currents on the South-eastern Coasts of Newfoundland and the amount of indraught into the larger bays on the South Coast. From investigations of the Tidal and Current Survey in the season of 1903. W. Bell Dawson. Published by the Department of Marine and Fisheries, Ottawa, Canada. Ottawa, 1904. Size 10 × 7, pp. 32. *Map and Plates.*

Noticed in the Monthly Record for August.

North America—Historical. **Chittenden.**

The American Fur Trade of the Far West. A History of the Pioneer Trading Posts and Early Fur Companies of the Missouri Valley and the Rocky Mountains and of the Overland Commerce with Santa Fe. By H. M. Chittenden. 3 vols. New York: F. P. Harper, 1902. Size 10 × 6½, pp. xxiv. and 1030. *Map and Illustrations.*

A valuable work, with many bearings on the history of exploration in Western North America.

North America—Meteorology. *Meteorolog. Z.* **21** (1904): 262–273. **Wachenheim.**

Die Temperaturverhältnisse von Nordamerika. Von Dr. F. L. Wachenheim.

North America—Pacific Coast. **Manson.**

Rainfall on the Pacific Coast of North and South America and the Factors of Water Supply in California. By M. Manson. [Reprinted from *Journal of the Association of Engineering Societies*, vol. xxx., No. 3, March, 1903.] Size 9 × 6, pp. 14. *Map and Diagrams.*

CENTRAL AND SOUTH AMERICA.

Brazil and Argentine. ——

Guide for the South American Route. For the information of Tourists and Passengers. Published by the Royal Mail Steam Packet Company, 1904. Size 6 × 5, pp. 112. *Map and Illustrations.*

Brazil and Bolivia—Boundary. *B. American G.S.* **36** (1904): 215–216. ——

New Boundary between Brazil and Bolivia. *With Map.*

Brazil and British Guiana. **Nabuco.**

[Question des Limites du Brésil et de la Guyane Anglaise soumise à l'Arbitrage de S. M. Le Roi d'Italie.] Premier Mémoire (size 11 × 7½), Atlas (size 23 × 16), and Annexes, 5 vols. (size 13½ × 8½); Second Mémoire, 3 vols. (size 11½ × 7½), and Annexes, 3 vols. (size 13½ × 8½); Troisième Mémoire, 4 vols. (size 11 × 7½). Paris: A. Lahure, 1903–04. *Maps. Presented by Sr. Joaquim Nabuco.*

Besides stating the Brazilian case in the recent boundary question, these memoirs contain a detailed examination of the British case, and a reprint of many documents bearing on the question.

Chile. **Patron.**

República de Chile, Oficina de Limites. La Cordillera de los Andes entre las latitudes 30° 40′ i 35° S. Trabajos i estudios de la Segunda Sub-Comision Chilena de Límites con la República Arjentina. Luis Riso Patron, S. Santiago de Chile, 1903. Size 11 × 7½, pp. x. and 258. *Maps and Illustrations. Presented by Sr. Luis Riso Patron.*

The first of a series of publications which are to present the results of the important survey expeditions undertaken in connection with the boundary question. The work to which it refers was done from 1894 onwards.

Chile. *Petermanns M.* **50** (1904): 140–144. **Steffen.**

Der Baker-Fjord in Westpatagonien. Von Dr. H. Steffen. *With Map.*

The map is a bathymetrical one based on surveys by the Chilean gunboat *Magallanes*, 1900.

Cuba. ——

Commercial Cuba in 1903. Area, Population, Production, Transportation Systems, Revenues, Industries, Foreign Commerce, and Recent Tariff and Reciprocity Arrangements. (From the *Summary of Commerce and Finance* for October, 1903.) Size 11½ × 9½, pp. 1147–1278. *Map.*

Intercontinental Railway.

Pan-American Railway. Report submitted to the Secretary of State by Charles M. Pepper, Commissioner to carry out the Resolution of the Second International Conference of American States. Washington, 1904. Size 9 × 6, pp. 76. *Map. Presented by the International Bureau of the American Republics.*

Martinique. *Science* **19** (1904): 927–928. **Gilbert.**

The Mechanism of the Mont Pelée Spine. By G. K. Gilbert.

In a later note (*Science*, July 22) the writer explains that this communication is an instance of unconscious plagiarism, the idea having been suggested some months earlier by Dr. Lane (see *ante*, p. 353).

Martinique. *Science* **19** (1904): 800–801. **Heilprin.**

The Nature of the Pelée Tower. By Prof. A. Heilprin.

Martinique. *Science* **20** (1904): 23–24. **Hovey.**

Mont Pelé from October 20, 1903, to May 20, 1904. By Dr. E. O. Hovey.

Nicaragua. *Periodical Accounts, Moravian Missions* **5** (1904): 503–505. **Heath.**

Karawala, a Christian Sumu Settlement. By Rev. G. R. Heath. *With Map and Illustration.*

AUSTRALASIA AND PACIFIC ISLANDS.

Pacific. **Lemire.**

L'Océanie Française. Les Intérêts français dans le Pacifique. Tahiti, Nouvelles-Hébrides, Canal de Panama. Par C. Lemire. Paris: Berger-Levrault & Cie., etc., 1904. Size 9 × 6, pp. 100. *Maps and Illustrations. Price 2fr.*

South Australia. **Maurice.**

South Australia. Extracts from Journals of Explorations by R. T. Maurice. Fowler's Bay to Rawlinson Ranges, and Fowler's Bay to Cambridge Gulf. Adelaide, 1904. Size 13½ × 8½, pp. 40. *Maps and Illustrations. Presented by R. T. Maurice, Esq.*

The journey was described in the *Journal* for June, 1902 (p. 760) and March, 1903 (p. 323).

South Australia—Geology. **Rennie and Higgin.**

T.R.S. South Australia **27** (1903): 205–206.

Notes on Supposed Volcanic Dust from the Northern Territory. By Prof. Rennie and A. J. Higgin.

POLAR REGIONS.

Antarctic. *C. Rd.* **138** (1904): 1447–1450. **Nathorst.**

Sur la flore fossile des régions antarctiques. Note de A. G. Nathorst.

See note in the August number (p. 230).

Antarctic. *Deutsch. G. Blätter* **27** (1904): 1–9. **Penck.**

Antarktika. Von Albrecht Penck.

Antarctic—Fauna. *Z. Ges. Erdk. Berlin* (1904): 362–370. **Vanhöffen.**

Die Tierwelt des Südpolargebiets. Von Prof. Dr. E. Vanhöffen. *With Illustrations.*

Antarctic—History of Exploration. *J. Franklin I.* **157** (1904): 81–88. **Balch.**

Antarctica Addenda. By Edwin Swift Balch. *Map.*

Supplementary to the information collected in the writer's 'Antarctica.'

Antarctic—Swedish Expedition. *Petermanns M.* **50** (1904): 117–121. **Bodman.**

Meteorologische Ergebnisse der Schwedischen Südpolarexpedition. Von O. Bodman.

Arctic. *Norske G.S. Aarbog* **14** (1902–3): 103–118. **Sverdrup.**

Den anden norske polarfoerd. Af Kaptein Otto Sverdrup.

Arctic. *Ann. G.* **13** (1904): 97–112. **Zimmermann.**

L'océanographie du bassin polaire boréal d'après Fridtjof Nansen. Par M. Zimmermann.

Arctic—Ice. **Garde.**

The State of the Ice in the Arctic Seas, 1903. Prepared by V. Garde. (Special print of the Nautical-Meteorological Annual of the Danish Meteorological Institute.) Size 12½ × 9½, pp. xxiv. *Maps.*

The actual facts in 1903 corresponded well, in the main, with the forecast made in 1902 (cf. vol. xxii. p. 218, and p. 355, *ante*).

Arctic—Norwegian Expedition. **Nansen.**

The Norwegian North Polar Expedition, 1893–1896. Scientific Results edited by Fridtjof Nansen. Volume iv. London: Longmans & Co., 1904. Size 12 × 9½, pp. 74, 18, and 232. *Plates. Presented by the Fridtjof Nansen Fund.*

Includes a memoir by Dr. Nansen on the Bathymetrical Features of the North Polar Seas. The other two memoirs are less distinctly geographical.

MATHEMATICAL AND PHYSICAL GEOGRAPHY.

Measurement of Areas. *P.R.S.* **73** (1904): 292–295. **Edwards.**

A Radial Area-Scale. By R. W. K. Edwards. *With Illustration.*

Primitive Cartography. *Deuts. G. Blätter* **27** (1904): 29–46. **Dröber.**

Kartographie bei den Naturvölkern. Von Dr. W. Dröber.

Surveying. *C. Rd.* **138** (1904): 1309–1312. **Laussedat.**

Sur l'emploi d'images stéréoscopiques dans la construction des plans topographiques. Note de A. Laussedat.

Surveying Instrument. *Petermanns M.* **50** (1904): 148–150. **Hammer.**

Der Cyclograph von Ferguson. Von Prof. Dr. E. Hammer. *With Illustration.*

Time. *C. Rd.* **138** (1904): 1657–1659. **Bigourdan.**

Sur la distribution de l'heure à distance, au moyen de la télégraphie électrique sans fil. Note de G. Bigourdan.

Suggests the supply of time to ships on long voyages by means of wireless telegraphy.

PHYSICAL AND BIOLOGICAL GEOGRAPHY.

Glaciers. *Deutsch. Rundschau G.* **26** (1904): 410–413. **Dürnwirth.**

Von dem Köss. Von R. Dürnwirth.

Köss is an old form of "Kees" (snowfield or glacier), a note on which has been unearthed by the writer from an old manuscript of 1624, written by Martin Strasser, of Kollnitz, Carinthia.

Glaciers. *Ann. Club. Alpin Fr.* **29** (1902–1903): 347–398. **Girardin.**

Commission Française des Glaciers. Rapport sur les Observations Glaciares en Haute-Maurienne, dans les Grandes-Rousses et l'Oisans, dans l'été de 1902. Par M. Paul Girardin. *Illustrations. Also separate copy, presented by the French Glacier Commission.*

Glaciers. *Globus* **85** (1904): 377–379. **Lendenfeld.**

Ueber die Abschmelzung der Gletscher im Winter. Von R. von Lendenfeld.

Hydrology. **Martel.**

L'enfouissement des eaux souterraines. Le reboisement obligatoire. L'exploration hydrologique souterraine des Pyrénées. Communication présentée au Congrès du Sud-Ouest Navigable de Toulouse. Par E. A. Martel. Toulouse; É. Privat, 1904. Size 9½ × 6½, pp. 8. *Presented by the Author.*

Hydrology—Divining-rod. **Heim.**

Vierteljahrs. Naturforsch. Ges. Zürich **48** (1903): 287–306.

Geologische Nachlese, von A. Heim. Nr. 13, Einige Beobachtungen betreffend die "Wunschelrute."

On the use of the divining-rod as a supposed means of discovering springs of water.

Hydrology—Hot Springs. *Geolog. Mag.* **1** (1904): 252–260. **Schwarz.**

Hot Springs. By E. H. L. Schwarz. *With Section.*

Icebergs. *Nautical Mag.* **73** (1904): 354–367. **Allingham.**

Northern and Southern Ice. By W. Allingham.

Limnology—Instrument. *Petermanns M.* **50** (1904): 129. **Halbfass.**

Eine bemerkenswerte Verbesserung des Sarasinschen Limnimètre enregistreur portatif. Von W. Halbfass.

Describes an improvement of the Sarasin instrument for registering fluctuations of lake-levels, devised by Lieut. Schnitzlein of Munich.

ANTHROPOGEOGRAPHY AND HISTORICAL GEOGRAPHY.

Climate and History. ———

Climate and History. The Physical Causes of the Migration of Civilization. London, [not dated]. Size 8½ × 5½, pp. 16.

Discusses probable changes of climate within historic times, and their effect on human history.

Commercial Geography. *Deuts. G. Blätter* **27** (1904): 10–28. **Eckert.**

Wesen und Aufgaben der Wirthschafts- und Verkehrsgeographie. Von Max Eckert.

Historical. *B. American G.S.* **36** (1904): 193–215. **Stevenson.**

Martin Waldseemüller and the Early Lusitano-Germanic Cartography of the New World. By E. L. Stevenson.

Historical—Benjamin of Tudela. **Grünhut and Adler.**

Die Reisebeschreibungen des R. Benjamin von Tudela nach drei Handschriften, aus dem 13. und 14. Jahrhundert stammend, und ältern Druckwerken ediert und übersetzt, mit Anmerkungen und Einleitung versehen von Dr. L. Grünhut und M. N. Adler. I. Teil. Hebräischen Text. II. Teil. Einleitung, Uebersetzung und Register. Frankfurt a. M., 1903–4. Size 8 × 5, pp. (part 1) 164, (part 2) 28; and 102. *Maps. Price* 2.50*m. each part.*

Historical—Early Travel. **Joubert.**

B.S.G. Lisboa **21** (1903): 393–399; **22** (1904): 5–10.

François le Gouz de la Boullaye, Gentilhomme angevin dit le "Voyageur Catholique" (1610–1669). Por J. Joubert.

Historical—Tabrobane. *J.R. Asiatic S.* (1904): 539–541. **Ferguson.**

The "Taprobane" of Pliny and Ptolemy. By Donald Ferguson.

The writer regards the Taprobanian embassy of Pliny as perhaps mythical, certainly not sent from Ceylon, and considers that Ptolemy's Taprobane was probably Sumatra.

History of Geography. **Günther.**

Geschichte der Erdkunde. Von Dr. S. Günther. (Die Erdkunde . . . herausgegeben von M. Klar, I. Teil.) Liepzig und Wien: F. Deuticke, 1904. Size 10½ × 7, pp. xii. and 344.

BIOGRAPHY.

Grandidier. *Deutsch. Rundschau G.* **26** (1904): 373–375. **Miessler.**

Guillaume Grandidier. Par A. Miessler. *With Portrait.*

Tippu Tip. **Brode.**

M. Seminars Orient. Sprachen Berlin **5** (1902): 3 Abt. 175–277; **6** (1903): 3 Abt. 1–55.

Autobiographie des Arabers Schech Hamed bin Muhammed el Murjebi, genannt Tippu Tip. Transscribirt und übersetzt von Dr. H. Brode.

An interesting sketch of the career of the famous Arab adventurer.

GENERAL.

Bibliography—De Bry's Voyages. ———

Catalogue of the De Bry Collection of Voyages, in the New York Library. (Reprinted from the *Bulletin* of the New York Public Library, May, 1904.) Size 10½ + 7½, pp. 14.

Dutch Language. **Thimm.**

Dutch Self-taught. With Phonetic Pronunciation. By Captain C. A. Thimm. London: E. Marlborough & Co., 1904. Size 7½ × 5, pp. 120. *Price* 2*s.* 6*d. Presented by the Publishers.*

Includes vocabularies, a brief outline of the grammar, and various idiomatic phases and sentences likely to be of use to travellers.

Educational—Excursions. *G. Teacher* 2 (1904): 153–158. **Lomas.**
Excursions and the Teaching of Geography. By J. Lomas. *Illustrations.*

French Colonies.
Ministère des Colonies, Office Colonial. Statistiques Coloniales pour l'anneé 1902. Commerce. Melun, 1904. Size 9½ × 6½, pp. xx. and 1024. *Presented by the French Government.*

NEW MAPS.

By E. A. REEVES, *Map Curator*, R.G.S.

EUROPE.

England and Wales. **Ordnance Survey.**

ORDNANCE SURVEY OF ENGLAND AND WALES:—Sheets published by the Director-General of the Ordnance Survey, Southampton, from August 1 to 31, 1904.

4 miles to 1 inch:—

East of England Manœuvre Map, 1904, with boundary printed in colour; folded in cover or flat in sheets, 1*s.*

2 miles to 1 inch:—

With hills and printed in colours, 9, 50; folded in cover or flat in sheets, 1*s. each.*
East of England Manœuvre Map, 1904, printed in colours, mounted on linen, encased, 2*s.*; on paper, encased, 1*s.* 6*d.*

1-inch:—

(Third edition) in outline, 225, 270, 1*s. each* (engraved).
(Third edition) printed in colours, 268, 269, 286, 330, 1*s. each.*

6-inch—County Maps (first revision):—

Leicestershire, 31 N.W., 37 S.E. **Shropshire,** 69 S.E. **Somersetshire,** 3 S.W., 17 S.E., 20 S.W., 23 S.E., 27 S.W., 35 (N.W. and N.E.), 38 N.W., 42 N.W., 43 N.W., 66 N.W. **Staffordshire,** 69 N.W. **Suffolk,** 80 N.E., 81 N.E., 82 S.E., 83 N.E. **Warwickshire,** 8 N.W. 1*s. each.*

25-inch—County Maps (first revision):—

Brecknockshire, XV. 6; XVI. 9, 10, 13, 14; XXI. 6, 7, 8, 10, 11, 12, 14, 15, 16; XXII. 1, 5, 9, 13; XXIII. 13; XXVII. 7, 8; XXX. 13; XXXIII. 7, 11; XXXIV. 1, 5, 9, 14, 15, 16; XXXV. 4, 8, 12, 13, 14, 15, 16; XXXVI. 2, 5, 6, 11, 13, 14, 15; XL. 3, 4, 5, 6, 7, 8, 10, 11, 12, 14; XLII. 1, 2, 5, 6, 9, 10. **Devonshire,** III. 12, 16; VI. 7; VII. 4, 10, 13; IX. 9, 10, 11, 12, 14, 15; XI. 1; XII. 10, 14; XIV. 2, 5, 6, 13; XV. 14; XXI. 1, 2, 5, 6; XXII. 3, 9, 10, 11, 12, 13, 16. **Leicestershire,** III. 1, 5, 9, 13; VI. 8, 12; VIII. 5, 9, 10, 13, 14; XLVII. 6, 9, 10, 13. **Lincolnshire,** CXIII. 1, 5, 9, 13; CXXII. 1, 2, 3, 4, 5, 7, 8, 9, 10, 11, 12, 14, 15, 16; CXL. 1, 10, 11, 12; CXLI. 2, 3, 7, 9, 10, 11, 12, 13, 14, 15, 16; CXLII. 14; CXLVII. 4, 6, 7, 9, 13, 14, 15; CXLVIII. 2, 3, 4, 11, 13, 14, 15, 16; CLI. 4, 6, 7, 8; CLII. 1, 3, 4, 7. **Rutland,** XIII. 12, 16; XIV. 5, 7, 9, 10; XV. 3, 6, 7, 10. **Somersetshire,** VI. 4. **Staffordshire,** LXVIII. 16; LXIX. 13; LXXII. 3, 4, 7, 11. **Suffolk,** XXXI. 8, 12, 16; XXXII. 9, 10, 13; XXXIII. 7, 8, 9, 10, 12, 13, 14, 16; XXXIV. 5, 6, 9, 10, 11, 12, 13, 14, 15, 16; XXXV. 5, 6, 8, 9, 11, 12, 13, 14, 16; XXXVI. 6, 7, 8, 9, 10, 11, 12, 14, 16; XXXVII. 6, 14; XLII. 3, 4, 7, 8, 12; XLIII. 9, 13; XLIV. 7; XLV. 1, 8; XLVI. 1, 4; XLVII. 4; XLVIII. 1, 2, 3, 4, 16; XLIX. 13; L. 10, 12, 14, 15; LIX. 4; LX. 2, 3. **Warwickshire,** VII. 16; VIII. 13; IX. 13; XIII. 3, 4, 7, 11; XX. 9. **Worcestershire,** V. 7, 11; VII. 4, 8, 15; XVI. 12; XXVIII. 15; XXXIII. 7, 13, 14, 15, 16; XXXIV. 13; XL. 1, 2, 3, 4, 5, 6, 7, 8, 10, 11, 12; XLI. 1, 5, 9. 3*s. each.*
(*E. Stanford, London Agent.*)

Germany. **Königl. Preuss. Landes-Aufnahme.**

Karte des Deutschen Reiches. Scale 1:100,000 or 1·6 stat. mile to an inch. Sheet 314, Magdeburg. Herausgegeben von der Kartogr. Abtheilung der Königl. Preuss. Landes-Aufnahme, 1904. *Price* 1.50 *mark each sheet.*

ASIA.

Asia. — **Service Géographique de l'Armée, Paris.**

Asie. Scale, 1 : 1,000,000 or 15·8 stat. miles to an inch. Sheets: 36 N. 108 E., Si-ngan Fou; 40 N. 108 E., Ning-hia Fou; 48 N. 126 E., Kharbin. Paris: Service Géographique de l'Armée, 1904.

China. — **Königl. Preuss. Landes-Aufnahme.**

Karte von Ost-China. Scale 1 : 1,000,000 or 15·8 stat. miles to an inch. Sheet: Dolon nor. Kartographische Abtheilung der Königl. Preuss. Landes-Aufnahme, 1904. *Price* 1.50 *mark each sheet.*

This sheet includes the part of Mongolia lying between 42° and 46° N. lat. and 112° and 118° E. long., and contains information concerning the character of the country, caravan routes, etc. It is, however, to be regretted that the route survey of Mr. C. W. Campbell, who passed through the region shown on the eastern part of the sheet, and which is laid down on a large scale map in the *Geographical Journal* for November last, has not been taken full advantage of. Mr. Campbell has had considerable experience at route surveying, and his work gives fresh information concerning the country traversed, besides correcting the positions of places which were formerly laid down with the roughest approximation.

Manchuria. — **Service Géographique de l'Armée, Paris.**

Théâtre des Opérations en Mandchourie. Scale 1 : 1,000,000 or 15·8 stat. miles to an inch. Paris: Service Géographique de l'Armée, 1904.

This map is based upon the French 1 : 1,000,000 Carte de l'Asie, published by the Service Géographique de l'Armée. Fresh information has been added, and many place-names appear which were not given before.

AFRICA.

Africa. — **Intelligence Division, War Office.**

Africa. Scale 1 : 250,000 or 3·9 stat. miles to an inch. Northern Nigeria (Provisional). Sheets: 62—C, G, H, K, L, O, P. London: Intelligence Division, War Office, 1904. *Price* 1*s.* 6*d. each sheet. Presented by the Director of Military Operations.*

Comoro Islands. — **Meunier.**

Carte des Iles Comores, dressée par A. Meunier, 1903. Paris: Service Géographique et des Missions.

Seven plans of the Comoro Islands, on one sheet, based upon the surveys and sketches of Captain Dubois, MM. Coste, Le Houx, and other officers of the French navy. Heights are given by contour lines and figures, but no soundings round the coast are laid down. These would have added considerably to the interest of the plans, and rendered them far more instructive.

Egypt. — **Egyptian Survey Department.**

Topographical Map of Gharbia Province. Scale 1 : 10,000 or 0·15 stat. mile to an inch. Sheets: N.W. 37—3 and 38—2. Provisional Map of Assiut Province. Scale 1 : 50,000 or 0·78 stat. mile to an inch. Cairo: Survey Department, 1904. *Presented by the Director-General, Survey Department, Cairo.*

Egypt. — **Grünau and Steindorff.**

Karte der Leipziger Expedition in die Libysche Wüste, November, 1899, bis Januar, 1900. Nach Aufzeichnungen Freih. C. v. Grünau's u. Prof. Dr. Steindorff's. Scale 1 : 1,300,000 or 20·4 stat. miles to an inch. *Petermanns Geographische Mitteilungen*, Jahrgang 1904, Tafel 12. Gotha: Justus Perthes, 1904. *Presented by the Publisher.*

German East Africa. — **Sprigade and Moisel.**

Karte von Deutsch-Ostafrika. Begonnen unter Leitung von Dr. Richard Kiepert, fortgesetzt unter Leitung von Paul Sprigade und Max Moisel. Scale 1 : 300,000 or 4·7 stat. miles to an inch. Sheet G 4 and H 4, Ssongea. Berlin: D. Reimer (Ernst Vohsen). *Presented by Herr Max Moisel.*

South Africa. — **Johnston.**

Map of South Africa. Scale 1 : 1,520,640 or 24 stat. miles to an inch. London and Edinburgh: W. and A. K. Johnston, 1904. 2 sheets. *Presented by the Publishers.*

A new edition of a wall map of South Africa. The physical features are not well brought out, and such indication of mountain ranges and relief as exist is to a

great extent obliterated by the unnecessarily heavy colouring used to show the political divisions.

Witwatersrand Goldfields. **Flowers.**

Standard Map of the Witwatersrand Goldfields, compiled at the "Map Office," Johannesburg, by Frank Flowers, C.E. Scale 1 : 40,000 or 0·6 stat. mile to an inch. Johannesburg: The Argus Printing and Publishing Company, 1904. *Presented by Frank Flowers, Esq.*

Although this map is called a new edition in the prospectus which accompanies it, it is practically a new compilation, containing fuller information than that given on the map published five years ago by Messrs. Wood and Ortlepp, with corrections and additions to bring it up to date. The scale is now 1 : 40,000, which is slightly smaller than that of the earlier map. Several inset plans have been added.

AMERICA.

Argentine Republic. **Rohde.**

Mapa General de la Republica Argentina y de los Paises Limitrofes. Scale 1 : 2,500,000 or 39·4 stat. miles to an inch. 4 sheets. Publicado bajo los auspicios del Instituto Geografico Argentino por el Coronel Don Jorge J. Rohde. Buenos Aires, 1903.

A new edition of a map of Argentina which first appeared in 1896. Much new survey work, including that of the Chilian and Argentine boundary commissioners, has been done since that date, and this is now shown in red, together with the new boundary line, railways, &c. The execution of the map is rough and somewhat confused, but it contains useful information.

Bolivia. **Jerrmann.**

Reise in Ost-Bolivien, 1898, von Kapitän Ludwig Jerrmann. Scale 1 : 3,000,000 or 47·3 stat. miles to an inch. *Petermanns Geographische Mitteilungen*, Jahrgang 1904, Tafel 13. Gotha: Justus Perthes, 1904. *Presented by the Publisher.*

Brazil. **Posnansky.**

Mapa del Rio Acre. Scale 1 : 210,000 or 3·3 stat. miles to an inch. Por el Ingeniero Arturo Posnansky, año 1897 á 1900. La Paz: Oficina Nacional de Inmigración Estadistica. *Presented by the Oficina Nacional de Inmigración Estadistica.*

Canada. **Department of the Interior, Canada.**

Map showing Mounted Police stations in North-Western Canada, 1904. Scale 1 : 2,217,600 or 35 stat. miles to an inch. 2 sheets. Map showing Mounted Police stations in the North-West Territories, 1904. Scale 1 : 792,000 or 12·5 stat. miles to an inch. 2 sheets. Ottawa: Department of the Interior. *Presented by James White, Esq., Geographer, Department of the Interior, Canada.*

The Mounted Police stations are shown on these maps by flags which are in red, together with the names, and tables are given of the distances between them. Indian Reserves are also shown, as well as railway and telegraph lines. Apart from the special purpose for which the maps have been published, they contain a great deal of general information.

Canada. **Department of the Interior, Canada.**

Railways in Manitoba, Assiniboia, Alberta, and Saskatchewan, 1904. Scale 1 : 2,217,600 or 35 stat. miles to an inch. Ottawa: Department of the Interior. *Presented by James White, Esq., Geographer, Department of the Interior, Canada.*

The progress of railway development in Western Canada is clearly shown on this map. The railways opened are indicated by a thick black line, and those under construction by a broken black line. The rapid progress in railway extension to the north of the Canadian Pacific main line is seen at a glance at this map.

Canada. **Department of the Interior, Canada.**

Standard Topographical Map. Scale 1 : 250,000 or 3·9 stat. miles to an inch. Ontario, Windsor Sheet 1 s.w., Essex, Kent, and Lambton, and portions of Elgin, Middlesex, and Huron counties. Ottawa: Department of the Interior, 1904. *Presented by James White, Esq., Geographer, Department of the Interior, Canada.*

Canada. **Surveyor-General's Office, Ottawa.**

Sectional Map of Canada. Scale 1 : 190,080 or 3 stat. miles to an inch. Red-Deer sheet 77, West of Fourth Meridan, revised to July 5, 1904. Ottawa: Surveyor-General's Office, 1904. *Presented by the Surveyor-General of Canada.*

La Paz. **Oficina Nacional de Inmigración Estadistica, La Paz.**

Plano de la Ciudad de La Paz. Lavantado por la Comision Topografica, 1902. Scale 1:4000 or 15·8 inches to one mile. Ensanche de la Ciudad de La Paz, 1903. Scale 1:1000 or 63·36 inches to one mile. La Paz: Oficina Nacional de Inmigración Estadistica. *Presented by the Oficina Nacional de Inmigración Estadistica.*

Uruguay. **Gonzalez.**

Carta Geografica de la Republica Oriental del Uruguay. Scale 1:500,000 or 7·9 stat. miles to an inch. 4 sheets. Construida por Melitón Gonzalez. Editada bajo los auspicios del Ministerio de Fomento, 1900.

GENERAL.

World. **Hartleben.**

A. Hartleben's Volks-Atlas enthaltend 72 Karten in Einhundert Kartenseiten. Vierte-Auflage. Lieferung 11–13. Vienna and Leipzig: A. Hartleben, [1904]. *Price 50pf. each part.*

World. **Stieler.**

Neue, neunte Lieferungs-Ausgabe von Stielers Hand-Atlas, 100 Karten in Kupferstich, 33 and 34 Lieferung. Gotha: Justus Perthes, *Price 60pf. each part.*

Parts 33 and 34 are in one cover, and contain maps Nos. 9 and 10, two sheets (Nos. 1 and 2) of the map of the German Empire on the scale of 1:1,500,000, and Nos. 19 and 20, forming sheets Nos. 3 and 4 of the map of Austria Hungary on the scale of 1:1,500,000. All of these are from the drawings of C. Vogel, and are new and revised editions.

CHARTS.

North Atlantic and Mediterranean. **Meteorological Office.**

Pilot Chart of the North Atlantic and Mediterranean for September, 1904. London: Meteorological Office. *Price 6d. Presented by the Meteorological Office, London.*

United States Charts. **United States Hydrographic Office.**

Pilot Charts of the North Atlantic Ocean for August, and of the North Pacific Ocean for September, 1904. Washington: U.S. Hydrographic Office, 1904. *Presented by the U.S. Hydrographic Office.*

PHOTOGRAPHS.

Upper Nile. **Wilson.**

Sixty-two photographs of the Upper Nile and its environs, taken by Captain H. H. Wilson. *Presented by Captain H. H. Wilson.*

Captain Wilson has had exceptional opportunities of becoming acquainted with the Upper Nile region above Fashoda, having spent some years there, occupied with surveying and other duties in the service of the Government. These photographs were taken by him during the years 1900 and 1901, and those of the Galla country between Goré and Itang are specially interesting. He has just started again for the region, and doubtless will be able to add still further to the series of photographs he has already taken. The titles are as follows:—

(1) The Negadros Burro and wife at Goré; (2) Ras Tesemma Nado in his "diplomatic" dress; (3) Ras Tesemma Nado, Governor of Goré; (4 and 5) Ras Tesemma Nado and gun-bearers; (6–9) Abyssinian soldiery; (10) Purchasing mules and cows in Abyssinia; (11) Bridge over river in Abiv district of Goré; (12) Ato Melka and the Negadros Burro; (13) The Kainyasmach Duballa; (14) Typical view near Bure; (15) Distant view of Goré mountain; (16) The Baro Gorge; (17) Cattle market at Bure; (18) Purchasing cows at Bure; (19) Towing a boat up the Baro river near Kano; (20) Base camp at eastern mouth of Adura river; (21) Boat drifting down Baro river; (22) View on Baro river; (23) "Faidherbe" island on Baro river; (24) View on Baro river; (25 and 26) Abwong, on Sobat river; (27) The Zaptia, or police-station at Abwong; (28) Camp on the Sobat river; (29) Garden at Abwong; (30) Fawel, on Sobat river; (31) Village on Sobat river; (32) Anyuaks at Itang, on Baro river; (33) Anyuaks at Fatiwanyang, on Sobat river; (34) Paying Anyuaks for cutting fuel for steamer at Yakwoik; (35) Purchasing ivory from Dinkas at Khor Atar; (36) Dinka women at Dunjol; (37) Dinka cattle in Dunjol; (38) Dinka skeikhs at Bor; (39) Dinka skeikhs and followers at Demtemma; (40) Dinka village

in Dunjol; (41) Dinka cattle at Fanathiang; (42) Patrol halting in Dinka village in Dunjol; (43) Steel boat on Khor Adar, near junction with White Nile; (44) Camp on Khor Adar, near White Nile; (45) Three Dinka and one Arab skeikh at Renk; (46) Shilluks at Kaka, on White Nile; (47) Police officer's house at Demtemma; (48) Old French garden at Kodok; (49) Fording Khor Rao, near Jebel Ahmed Aga; (50) Kinana Arabs bringing in dura on bullocks for sale at Kodok; (51) View of Jebel Lado, from Mongalla; (52) Melut; (53) Garden at Renk, on White Nile; (54) The "Gordon Pasha" at Renk; (55) "Tawfs," or floating-grass islands on White Nile near Kodok; (56) Inspector's house at Mongalla; (57) Banana plantation at Kodok; (58) Floating timber down Blue Nile at Khartum; (59) Nuers on Baro river; (60) Nuers from Bahr-el-Zeraf, on a visit to the governor of Kodok: (61) Steel boat in reeds on White Nile at Melut; (62) Nuer cattle on Bahr-el-Zeraf.

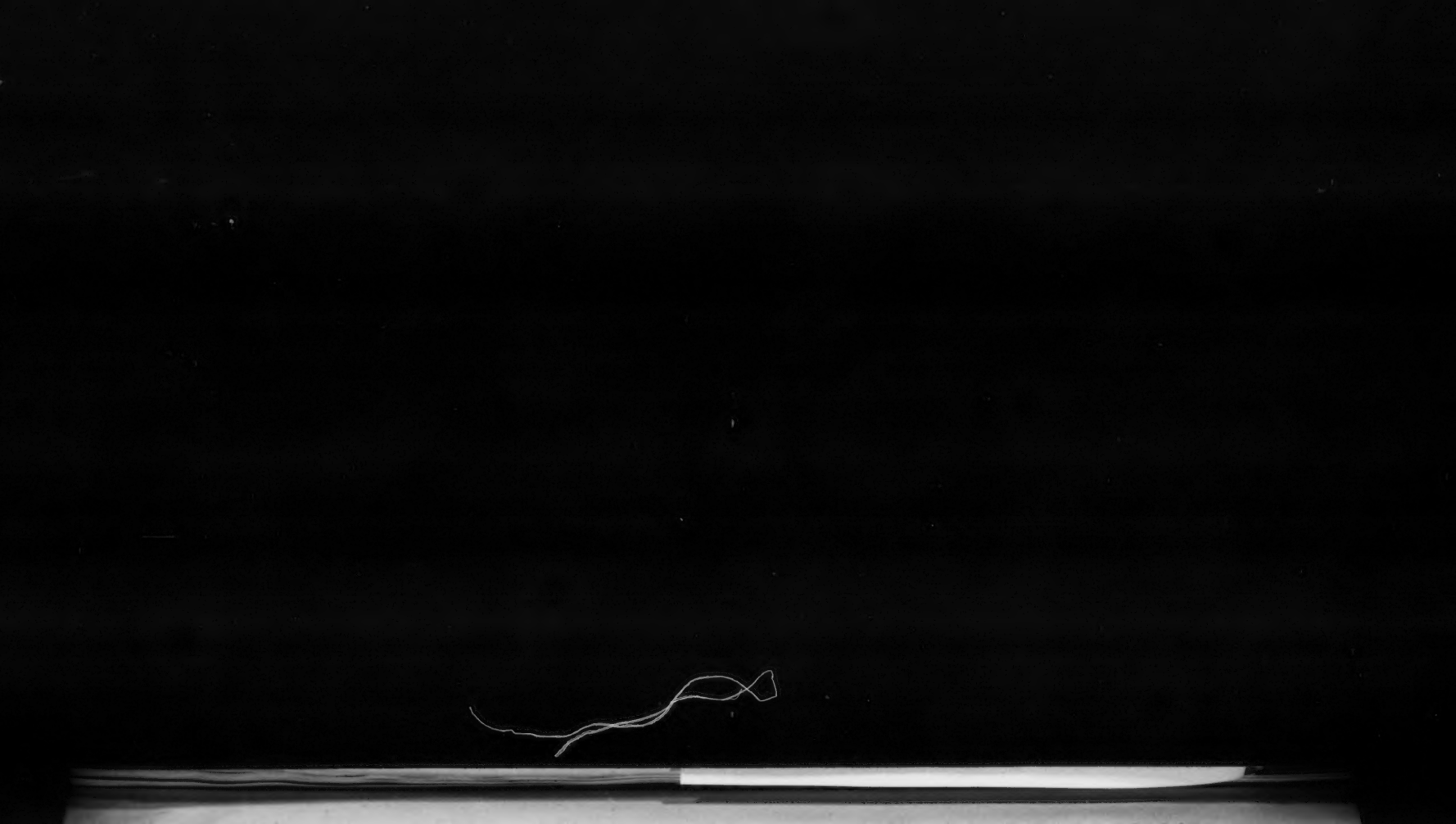
Sarawak. **Sternberg.**

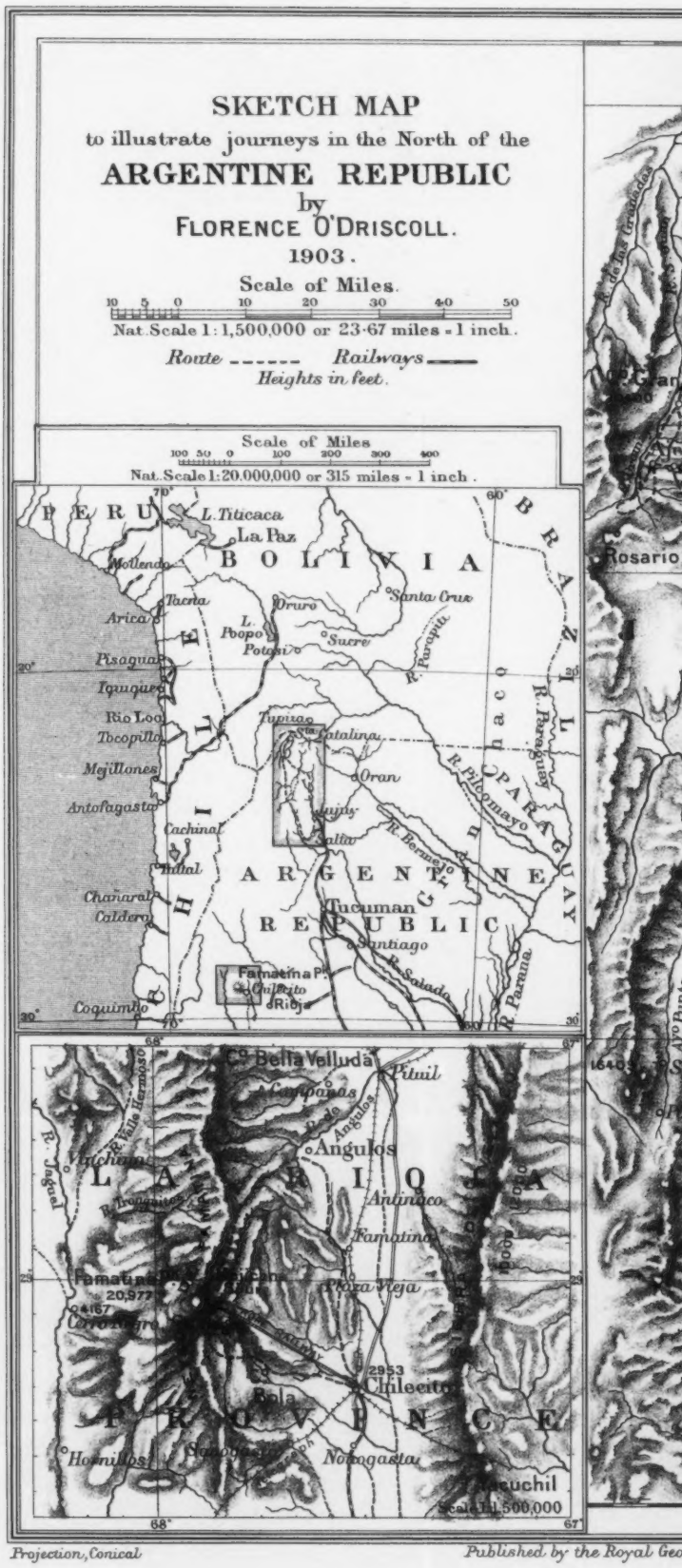
Ninety-one Photographs of Sarawak, taken by F. R. Sternberg, Esq. *Presented by F. R. Sternberg, Esq.*

As will be gathered from the titles, these are most interesting photographs, specially from an anthropological point of view. Those showing the tattoo markings of the Kayáns are perhaps unique:—

(1) The palace from Kuching; (2) Side view of palace; (3) The park at back of palace; (4) Drawing-room in palace; (5) The Rangers, men of H.H. the Rajah's army; (6) Band of Rangers playing in the palace grounds; (7) A Ranger in mufti; (8) Rangers in gala costume; (9) Rangers, showing filed teeth with brass springs inserted; (10) A Ranger's wife; (11) A Ranger's wife, showing head ornament invented by a former Resident; (12) The fort and surroundings adjacent to palace; (13) Kuching from palace grounds; (14) Government buildings, Kuching; (15) The Datu Hak Kun, Malay official; (16) Principal business street, Kuching; (17) Band stand, Kuching; (18) Museum, Kuching; (19) Police-station, Kuching; (20) Chinese theatre, Kuching; (21) A Dyak in the Main Road, Kuching; (22) Chinese procession, Kuching; (23) View of Kuching and the river, the Rajah's yacht in mid-stream; (24) Village at mouth of Rajang river; (25) Government buildings, Bau; (26) Court House, Bau; (27) Native football players, Bau; (28) Principal street, Bau; (29–31) Malay houses on road to river, Bau; (32) Gold works, Bidi; (33) Mr. Sternberg's Malay servant; (34) Sarawak Government steamer *Kaka;* (35) H.H. the Rajah Muda interviewing Dyak chiefs at the Residency, Sibu; (36) A group of Dyak head-hunters, who have been fined, and have submitted to Government; (37) Football at Sibu; (38) Golf caddies, Sibu; (39) Front view of a Dyak chief; (40) Back view of a Dyak chief; (41) Three Kayans; (42) Kayan, showing ear ornament; (43) Heads taken by Government from head-hunters; (44) The largest war canoe ever seen in Sarawak; (45) Government boat in which Mr. Sternberg visited Dyak house; (46) Dyak house; (47) Dyak house seen from below; (48) Entrance to Dyak house; (49) The inside balcony; (50) Door of room in Dyak house; (51) Skulls in Dyak house; (52) Women inhabitants, Dyak house; (53) Women and girls, Dyak house; (54) Mr. Sternberg and Dyak women; (55) Dyak children; (56) Melanau house in jungle; (57) Melanau girl; (58) Melanau youth playing nose flute; (59) Fort Kenowit on Rajang river; (60) Government steam-launch *La Fé;* (61) H.H. the Rajah Muda and bull-dog; (62) Taking passengers on the launch; (63) A Dyak hostage; (64) Hostage being paddled ashore; (65) A Moloh house, Rajang river; (66) Dyak women married to a Moloh; (67) Moloh children; (68) Fort Kapit, Rajang river; (69) Grounds and lake at Fort Kapit; (70) H.H. the Rajah Muda holding conference with Dyaks at Fort Kapit; (71) Jars taken from head-hunters; (72) Gongs taken from head-hunters; (73) H.H. the Rajah Muda conversing with Dyaks; (74) A group of Dyaks at Fort Kapit; (75) Dyak blowing dart from blow-pipe, Fort Kapit; (76 and 77) A Ukit covered back and front with tattoo marks; (78) Dyak woman and child; (79–83) Tuba fishing; (84) Chinese leaders of rebellion in 1899; (85) Chinese village on Sarawak river; (86) Kayan woman's hand and forearm, showing tattoo marks; (87–91) A complete set of the tattoo marks of the Kayans.

N.B.—It would greatly add to the value of the collection of Photographs which has been established in the Map Room, if all the Fellows of the Society who have taken photographs during their travels, would forward copies of them to the Map Curator, by whom they will be acknowledged. Should the donor have purchased the photographs, it will be useful for reference if the name of the photographer and his address are given.




SKETCH MAP
to illustrate journeys in the North of the
ARGENTINE REPUBLIC
by
FLORENCE O'DRISCOLL.
1903.
Scale of Miles.
10 5 0 10 20 30 40 50
Nat. Scale 1: 1,500,000 or 23·67 miles = 1 inch.
Route ------ Railways ——
Heights in feet.
Scale of Miles
100 50 0 100 200 300 400
Nat. Scale 1: 20,000,000 or 315 miles = 1 inch.
PERU
BOLIVIA
BRAZIL
CHILE
ARGENTINE REPUBLIC
PARAGUAY
L. Titicaca
La Paz
Mollendo
Tacna
Arica
Oruro
Santa Cruz
L. Poopo
Potosi
Sucre
R. Paraguay
Pisagua
Iquique
Rio Loa
Tocopilla
Tupiza
Santa Catalina
Mejillones
Oran
R. Pilcomayo
Antofagasta
Cachinal
Salta
R. Bermejo
Tolal
Chanaral
Caldera
Tucuman
Santiago
R. Salado
Famatina
Chilecito
La Rioja
Coquimbo
R. Parana
Rosario
Cerro Bella Vellida
Pituil
Campanas
Angulos
Vallecito
Antinaco
Famatina
Famatina
20,577
24167
Cerro Negro
Vaca Vieja
2953
Chilecito
Bola
Hornillos
Sanagasta
Nonogasta
Vasuchil
Scale 1:1,500,000
Projection, Conical
Published by the Royal Geo

ARGENTINE REPUBLIC

O'DRISCOLL

Royal Geographical Society.

MAP OF THE

SIERRA LEONE - LIBERIA BOUNDARY

Surveyed by Capt. H. D. Pearson, R.E., & Lieut. E. W. Cox, R.E.

British Commissioners, Anglo-Liberian Boundary Commission, 1903.

Scale 1/500000 or 7·8 Miles to 1 Inch

Miles 5 4 3 2 1 0 5 10 15 Miles

11°30′

9°

8°30′

8°

S I E R R

L E O N

Fanama 1900

Grass

Kumadu

Talia

Windedu

Kwardu

Tombaua

Sugua

Kintabai

R. Bess

Labella

To Bana

R. Mende

Miama

To Fainde

Yeredu 1500

Gomahun

Open rock

R. Tegne

Yenyema

Bahua

Gamado

Yendema

1535 Johama

Tree Bush

Bendu

Grass Jungle

Tree bush

R. Moppipi

Gunduma

R. Kaia

Mangama 1052

Geia

Kama

Tikonko

Tekong

Giema

Gehun

Kundema

R. Takaya

Kotuma

Gwala

1230 Panguma

Dodo

R. Mokpoma

Gerahun

R. Bess

Baoma

220 Taninahun

Yagema

Yeh

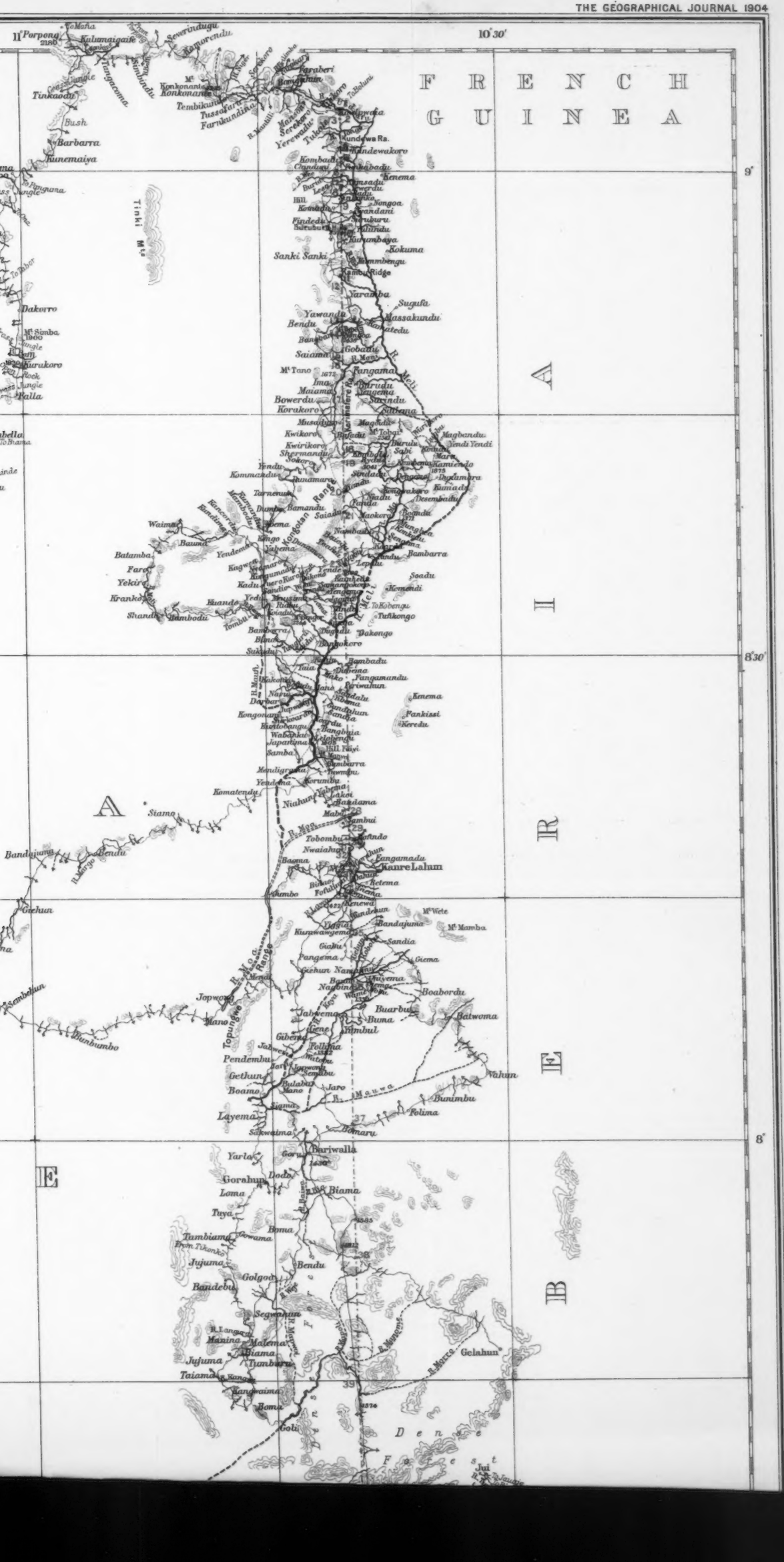
Loma

Giema

Gehun

R. Wart

Band


FRENCH GUINEA
10°30'
9°
8°30'
8°
Porpona
Kulumaigaie
Tinkaodu
Barbarra
Kunemaiya
Tinki Mts
Dakorro
Mt. Simba
Kurakoro
Falla
Sanki Sanki
Yaramba
Sugufa
Massakundu
Yawandu
Bendu
Gobadu
Saiama
Mt. Tano
Fangama
Imo
Maiama
Bowerdu
Korakoro
Sukuma
Kwikoro
Kwirikoro
Shermandu
Yendu
Kommandu
Runamaru
Tormemu
Dumbo
Bamandu
Waima
Baima
Batamba
Faro
Yekiri
Shandu
Bambodu
Bambara
Bambakoro
Dakongo
Tutkongo
To Kobengu
Siama
Bandajuma
Bendu
Gbehun
Sembehun
Bunbumbo
Jopwoma
Mano
Topuma
Pendembu
Gethun
Boamo
Layema
Kanre Lahun
Kenema
Pankissi
Keredu
Mt. Wete
Mt. Mamba
Sandia
Giema
Boabordu
Buarbu
Batwoma
Yahun
Bunimbu
Polima
Bariwalla
Gorahun
Loma
Biama
Tuya
Boma
Tambiama
Jujuma
Golgodu
Bandebu
Segwahun
Mazina
Malema
Taiama
Gelahun
Goli
Denie
Forest
Jui

Published by the Roya

Reference

Trigonometrical heights based on height fixed by aneroids and boiling point thermometers at Tembidundo thus 1570

Other heights by aneroid thus 510

Trigonometrical points and traverse stations thus .....

Towns and villages thus ..... Deserted do. .....

Anglo-Liberian boundary thus .....

Boundary Pillars 27

The longitudes on this map are shewn as determined by the Survey of the Boundary Commission and are referred to the position of Tembidundo which is taken as 10° 47'

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